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Texas Air Control Board, Austin

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USERS' GUIDE

Texas Episodic Model

Texas Air Control Board

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The Texas Episodic Model Version 8 (TEM8) is a Fortran computer program designed to predict ground level, short-term concentrations of atmospheric pollutants. This model uses a technique, first introduced in the Texas Climatological Model, that requires much less computer time than most short-term models. Predictions are based upon the steady-state Gaussian plume hypothesis, Briggs plume rise formulations, and Pasquill-Guifford dispersion coefficient approximations.

The TEM-8 is a general purpose model that has many applications. Ground level concentrations for one or two pollutants can be determined for time periods from 10 minutes to 24 hours. TEM-8 maintains the assumption that the mass of the plume cross section is conserved for all averaging times. Up to 300 individual point sources and up to 50 area sources may be input to the model. (These size limits are easily expanded.) A wide variety of meteorological conditions may be used to include variations in wind speed, wind direction, atmospheric stability class, temperature, and mixing height.

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Users' Guide

to the

TEXAS EPISODIC MODEL

by
Staff of the Texas Air Control Board

October 1979

Texas Air Control Board
Permits Section
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TEM MANUAL

1. MODEL OVERVIEW

1.1 BACKGROUND AND PURPOSE

The Texas Episodic Model Version 8 (TEM-8) is a Fortran computer program designed to predict ground level, short-term concentrations of atmospheric pollutants. This model uses a technique, first introduced in the Texas Climatological Model (published as the Fast Air Quality Model by Christiansen and Porter, 1975 [1]), that requires much less computer time than most short-term models. Predictions are based upon the steady state Gaussian plume hypothesis, Briggs plume rise formulations, and Pasquill-Gifford dispersion coefficient approximations. A few modifications and revisions have been made to the original model to increase its flexibility and utility. Most importantly, TEM-8 maintains the assumption that the mass of the plume cross section is conserved for all averaging times.

1.2 SCOPE AND USE

1.2.1 Applications

The TEM-8 is a general purpose model that has many applications. Ground level concentrations for one or two pollutants can be determined for time periods from 10 minutes to 24 hours. Up to 300 individual point sources and up to 50 area sources may be input to the model. (These size limits are easily expanded.) A wide variety of meteorological conditions may be used to include variations in wind speed, wind direction, atmospheric stability class, temperature, and mixing height. Plume rise is calculated by the most representative of six different methods. Exponential decay of pollutant concentration may be calculated when requested by the user. Up to 24 different sets of meteorological data may be input for determination of 24 distinct scenarios.

The TEM-8 is well suited for, but not limited to, the following applications:

1. Stack parameter design studies
2. Evaluation of the impact of new sources or source modifications for permit application review.
3. Fuel conversion studies.
4. Monitoring network design.
5. Control technology evaluation.
6. Control strategy evaluation.
7. Prevention of significant deterioration.

1.2.2 Limits of Use

Every dispersion model is limited by the assumptions used to predict pollutant behavior after release to the atmosphere. State of the art mathematical modeling techniques have been used throughout this model. Each predictive algorithm with limiting assumptions is discussed in detail later. General limitations are summarized as follows:

1. Sources: The number of point sources is limited to 300 and the number of area sources is limited to 50. Instructions are also provided so that the user can easily expand the number of point and/or area sources. All sources are stationary.

2. Scenarios: The number of different scenarios (sets of meteorological parameters) is limited to 24.

This model requires input of the Pasquill-Gifford atmospheric stability class.

3. Depletion mechanisms: The only depletion mechanism available in this model is exponential decay with the users' option to input any desirable half-life. Therefore, the TEM-8 is most suited to modeling relatively non-reactive pollutants such as sulfur dioxide, carbon monoxide, and particulates. The TEM-8 is not suited to modeling highly reactive pollutants such as hydrocarbons, oxidants, and oxides of nitrogen. Reflection of the plume at ground level is assumed with no depletion of the pollutants.

4. Terrain: The TEM-8 does not make adjustment for differences in terrain elevation between sources and/or receptors.

1.3 BASIC DEFINITIONS AND CONCEPTS

1.3.1 Basic Definitions

Air Contaminant - An air contaminant is particulate matter, dust, fumes, gas, mist, smoke, vapor or odor or any combination thereof produced by processes other than natural.

Air Pollution - Air pollution is the presence in the atmosphere of one or more air contaminants or combinations thereof, in concentration and of such duration as are or may tend to be injurious to, or to adversely affect human health or welfare, animal life, vegetation or property, or as to interfere with the normal use and enjoyment of animal life, vegetation, or property.

Dispersion Model - A dispersion model is a mathematical description of the meteorological transport and turbulent diffusion processes that affect pollutants emitted to the atmosphere. Usually a model will predict pollutant concentrations at some point of interest (receptor) from inputs of meteorological data, source data, and receptor location.

Stationary Sources - Stationary sources are pollution emission sources for which emissions can be identified with a plant or an area that remains geographically fixed.

Point Source - A point source is a single, identifiable stack that emits one or more pollutants at a defined rate. Normal parameters for dispersion model input are: pollutant emission rates, stack height, stack diameter, exit velocity, and exit temperature.

Area Source - An area source is a source of pollutants that is not identifiable as a point source. Typical examples of area sources are: a lagoon, a dump or solid waste disposal site, the side or large area of a building, an unpaved road or parking area, valves, vents, etc. Frequently, these are also called sources of fugitive emissions. In practice, it is often difficult to accurately define emissions from area sources. These sources are normally considered to emit pollutants at ground level.

Receptor - A receptor is a point on the ground at which the ambient air quality (pollutant concentration) is to be determined.

Receptor Grid - A receptor grid is a rectilinear set of adjacent squares of equal size with a receptor located at the intersection of each grid column and row. The TEM-8 can handle up to 2500 receptors in a 50 x 50 grid.

Averaging Time - This is the time interval over which variations in pollutant concentration at a receptor are averaged. Because instantaneous concentrations at a given receptor exhibit wide temporal variations, time averaged concentrations provide a better characterization of pollutant levels at the receptor. Averaging times available in the TEM-8 are 10 minute, 30 minute, 1 hour, 3 hour, and 24 hour. In addition, a variable number of 10 minute or 1 hour concentrations may be calculated and averaged together for up to a total of 24 scenarios.

Scenario - A scenario is a set of meteorological conditions that are input to the model to be used to predict pollutant concentrations at each receptor in the grid. These data are used to characterize the transport and turbulent diffusion properties of the atmosphere. Meteorological data input for the TEM-8 are: wind speed, wind direction, Pasquill-Gifford atmospheric stability class, mixing height, and ambient temperature.

Advection - Advection is the process of transport of an air parcel by the mean velocity field of the atmosphere. Advection is represented in the model by the azimuth of the wind.

Diffusion - Diffusion in the atmosphere is the exchange of mass between regions in space. Diffusion in the lower atmosphere is dominated by eddy exchange due to turbulent air movements, the magnitude of which is generally a function of atmospheric stability.

Turbulence - Turbulence is a state of fluid flow in which fluid particles (small masses) move in random, irregular paths. Instantaneous velocities exhibit irregular and random fluctuation.

Atmospheric Stability - Atmospheric stability characterizes the thermodynamic structure of the atmosphere. Frequently, it is defined by comparison of actual temperature lapse rate with the "dry adiabatic" lapse rate. Table 1-1 lists the stability classes used in the TEM-8.

Table 1-1

Pasquill Stability Class		TEM Nomenclature
A	extremely unstable	1
B	moderately unstable	2
C	slightly unstable	3
DD	neutral - day	4
DN	neutral - night	5
E	slightly stable	6
F	moderately stable	7

Mixing Height - The turbulent air near the ground is frequently bounded above by a layer of stable air. The distance from the ground to the bottom of the stable layer is the mixing height. This stable layer virtually prevents vertical dispersion above the mixing height.

1.3.2. Concepts

The TEM-8 takes a specific set of input data and predicts pollutant concentrations for a specific averaging time at each receptor in a predefined grid. Input requirements are source parameters for each point and area source, receptor grid location, meteorological data, and pollutant half-life. Source parameters include location, physical characteristics, and operating characteristics. Receptor grid input define the location and size of the grid. Meteorological inputs include atmospheric stability, mixing height, wind characteristics, and temperature.

The TEM-8 has three basic parts. The first calculates concentrations from point sources and includes plume rise and diffusion algorithms. Plume rise is determined by the most representative of six different methods developed by Briggs. Either buoyancy or momentum dominated plume rise can be determined. An option is made for stack-tip downwash of the plume. Building downwash is not considered. Plume transport and diffusion are modeled with the Gaussian plume dispersion model. This model uses dispersion coefficients developed by Pasquill and Gifford that relate dispersion to atmospheric stability and downwind distance from the source. A limit to vertical mixing can be incorporated in this model.

The second part of the TEM-8 determines concentrations from area sources. This algorithm is based upon one developed by Gifford and Hanna.

The third part of the TEM-8 predicts pollutant decay. The decay is exponential with the half-life of the pollutant input by the user.

1.4 SUMMARY OF INPUT DATA

Input into the TEM-8 can be divided into four sections:

1.4.1 Control Parameters

Control parameters remain constant throughout the model run. These parameters include:

1. Input option (read disk file or cards)
2. Input units
3. Receptor Grid
   - (a) Size of grid in number of columns and number of rows
   - (b) Location of west grid boundary and of south grid boundary
   - (c) Spacing of columns and rows
   - (d) Automatic grid option
4. Potential temperature gradient $d\theta/dz$ for calculation of plume rise with E and F atmospheric stability classes.
5. Averaging time
6. Number of pollutants

7. Pollutant calibration factors

8. Stack-tip downwash

9. Output options

    (a) Concentration map (none, calibrated and/or uncalibrated)
    (b) Punched card output
    (c) Culpability list (lists highest five contributors at each receptor)
    (d) Printout of maximum concentration for each scenario
    (e) Point source list option
    (f) List of concentrations at each receptor

1.4.2 Scenario Parameters

From one to twenty four scenarios may be used for each run. Each scenario uses the same set of point sources, area sources, and receptor grid. Meteorological parameter inputs for each scenario are:

1. Atmospheric stability class
2. Wind speed class or specific wind speed
3. Wind direction sector or specific wind direction
4. Ambient temperature
5. Pollutant half-life
6. Inversion penetration factor
7. Mixing height

1.4.3. Area Source Inventory

For each area source the following are input:

1. Source coordinates
2. Source size
3. Emission rates for 1 or 2 pollutants
4. Source height
5. Identification

1.4.4 Point Source Inventory

For each point source the following are input:

1. Source coordinates
2. Emission rates for 1 or 2 pollutants
3. Stack height

4. Stack diameter
5. Stack velocity
6. Stack temperature
7. Identification

1.5 SUMMARY OF MODEL OUTPUT

Output options are as follows:

1. Concentration List Option. All concentrations and coordinates at each grid receptor are printed one column per page.

2. Spatial Array Option. Concentrations in a map form display are printed. One, two, or four printed pages may be required per map. Calibrated or uncalibrated concentrations or both may be printed.

3. Punched Card Option. The concentrations and receptor coordinates for each receptor are punched onto cards. This option is for input to a contour plotting routine.

4. Culpability List Option. The percent contribution and source number are printed for the five highest contributors at each receptor.

5. Maximum Concentration Option. The maximum concentration for each scenario is printed.

6. Point Source List Option. Only the initial point source list is printed. The optional point source list giving the maximum effective stack height and dominant plume influence for each point source is suppressed.

2. TECHNICAL DISCUSSION

2.1 TEM-8 MODEL FORMULATION

The Texas Episodic Model Version 8 (TEM-8) is designed to predict ground level, short-term concentrations of atmospheric pollutants. Calculations are based upon the steady state Gaussian plume equation, Briggs plume rise formulation for buoyant and momentum dominated plumes, and the empirically derived Pasquill-Gifford 10 minute dispersion coefficients. Time averaged concentrations may be determined for time periods of 10 minutes, 30 minutes, 1 hour, 3 hours, or 24 hours. Additionally, 10 minute or 1 hour concentrations can be calculated and averaged for up to 24 different scenarios. Concentrations are determined for a rectilinear array of receptors whose size and location is defined by either the user or the automatic grid subroutine. Both area and point sources may be used. An option is available to approximate and to include effects of stack-tip downwash when appropriate. Options to limit vertical mixing and to calculate exponential pollutant decay may be used. This chapter presents in detail the technical basis of each component of the model along with references where appropriate.

2.2 METEOROLOGICAL DISPERSION

2.2.1 Point Source Algorithms

1. Basic Assumptions. The steady state Gaussian plume equation is based upon the following assumptions:

   a. The emission rate is constant and dispersion occurring in the downwind direction is negligible compared to advection.

b. The pollutants are transported downwind at an appropriate average wind speed. With the use of one average wind speed and constant wind direction, one assumes that the horizontal wind field is homogeneous and the effects of directional wind shear are neglected. Wind speed is adjusted to the physical stack height.

c. There is no directional wind shear in the vertical.

d. The plume is infinite with no plume history.

e. The pollutants are non-reactive gases or aerosols and remain suspended in the air following the turbulent movement of the atmosphere.

f. The plume is reflected at the earth's surface with no pollutant losses due to reaction or deposition at the surface.

g. Pollutants are dispersed by atmospheric turbulence and to a much lesser extent by molecular diffusion. The concentrations in both the crosswind and the vertical directions take the form of Gaussian distributions about the plume centerline.

2. The Gaussian Dispersion Equation. Using the Gaussian plume equation, the ground level concentration χ (in micrograms per cubic meter) at the point (x,y) may be written as

$$\chi(x,y,0,H) = \frac{Q\,10^6}{\pi\sigma_y\sigma_z\,U}\ \exp\left[-\tfrac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right]\ \exp\left[-\tfrac{1}{2}\left(\frac{H}{\sigma_z}\right)^2\right] \qquad (1)$$

where:

Q is the source emission rate, grams per second
U is the average wind speed at stack height, meters per second
σ_y, σ_z are the standard deviations of the concentration distributions in the crosswind and vertical directions respectively, meters
H is the effective stack height, which is the sum of stack height and plume rise, meters
x is the distance downwind from the stack, meters
y is the crosswind distance from the plume centerline, meters
z is the vertical distance from ground level, meters

The coordinate system used in equation (1) is illustrated in Figure 2-1. The more general form of equation (1) is described in Appendix A.

3. Dispersion Coefficients. The vertical dispersion coefficients, σ_z, used in the TEM-8 are identical to those used in EPA's Climatological Dispersion Model [2]. Values for σ_y and σ_z were derived from power law equations fit to the σ_y and σ_z curves reported by Turner [3]. The curves themselves were derived from empirical data by Pasquill [4] and Gifford [5]. The values of these coefficients are a function of atmospheric stability class and distance downwind from the source. Turner indicates that these values represent dispersion coefficients for a 10 minute averaging time, while other sources indicate that these values more closely represent averaging times for 3 minutes [6] or for 60 minutes [7]. The TEM-8 treats these values as a 10 minute averaging time.

The σ_y and σ_z curves determined by Pasquill and Gifford were derived from measurements taken in open, level to gently rolling terrain and may not be the best estimate of dispersion coefficients for urban areas or areas with rough terrain. As indicated in Section 2.2.2 on area source calculations, dispersion coefficients for urban areas may be estimated by decreasing the atmospheric stability class index by one, except for Class A.

These standard deviation functions may be approximated by a power law curve as follows:

$$\sigma_z = a(S)\ x^{b(S)} \qquad (2)$$

$$\sigma_y = c(S)\ x^{d(S)} \qquad (3)$$

where: a(S), b(S), c(S) and d(S) are functions of atmospheric stability

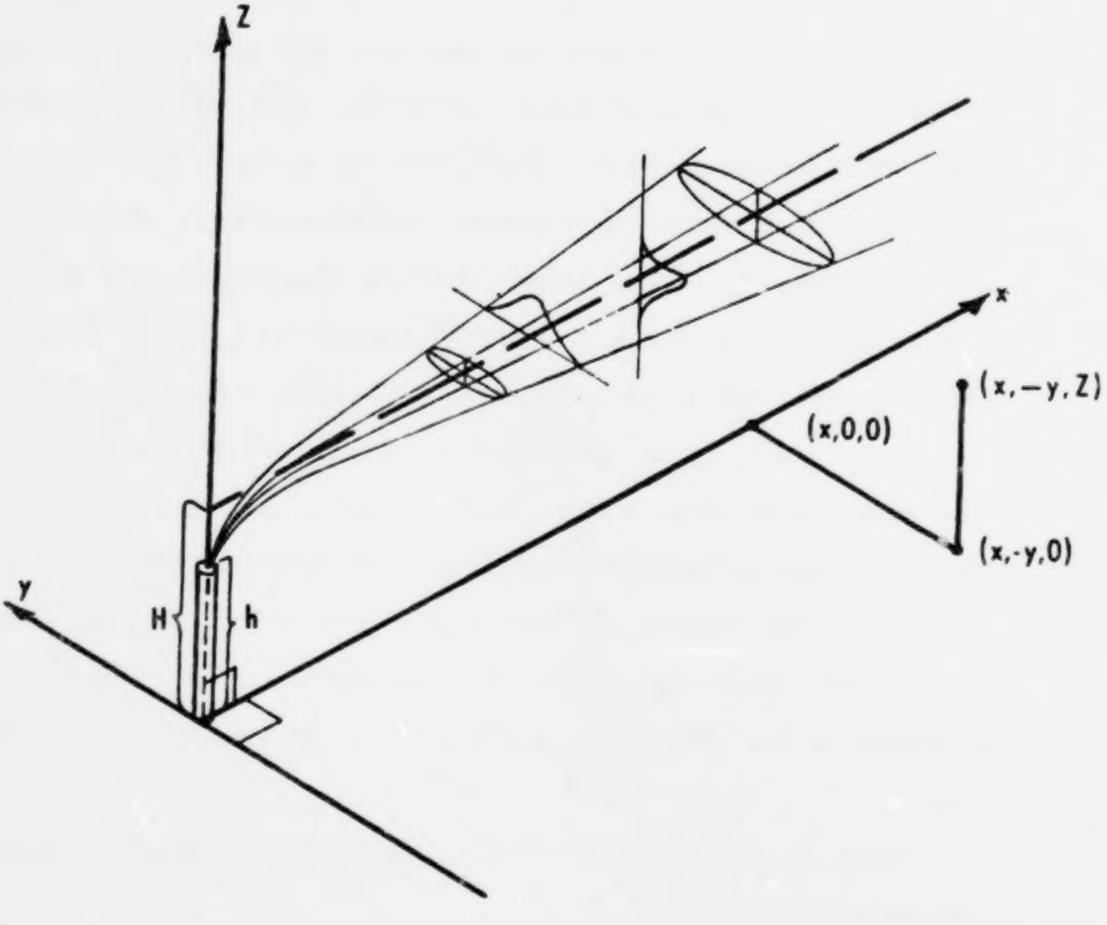

Z
x
(x,−y,Z)
(x,0,0)
(x,-y,0)
y
H
h

Figure 2-1 Coordinate System for the Gaussian Plume Equation

class, S. The values of a(S) and b(S) used in TEM-8 were determined by Busse and Zimmerman [2] for use in the Climatological Dispersion Model (CDM). These values are listed in Tables 2-1 and 2-2.

4. Averaging Time. The significant difference between TEM-8 and earlier versions is the method used for adjustment of time averaging periods. See Appendix B for a comparison between the two methods. The values for dispersion coefficients σ_y and σ_z used in the TEM-8 are based on a 10 minute time averaging period. For longer time averaging periods, σ_z values are unchanged while σ_y values are increased to represent the greater horizontal plume meander due to fluctuations in wind direction. The conversion of the σ_y values is:

$$\sigma_{yt} = \frac{\sigma_{y_0}}{\left(\frac{t_0}{t}\right)^{R(S)}} \qquad (4)$$

where:

σ_{y_t} is the horizontal dispersion coefficient for time period t
σ_{y_0} is the horizontal dispersion coefficient for time period t_0
t_0 is the base time period (10 minutes)
R(S) is a function of stability Class S as defined in Table 2-3 below. These values were derived by Singer [8] and Caraway [9]. See Appendix B.

TABLE 2-3

Atmospheric Stability Class	R(S)
A=1	0.675
B=2	0.55
C=3	0.425
DD=4	0.3
DN=5	0.3
E=6	0.175
F=7	0.175

This method of horizontal dispersion coefficient adjustment was suggested by Gifford [10] and is used since it satisfies the conserva-

TABLE 2-1

Power Law Exponents and Coefficients for σ_z

Atmospheric Stability Class	Downwind Distance, meters $100 < x \leq 500$		Downwind Distance, meters $500 < x \leq 5000$		Downwind Distance, meters $5000 < x$	
	a	b	a	b	a	b
A=1	.0383	1.281	.0002539	2.089	.0002539	2.089
B=2	.1393	.9467	.04936	1.114	.04936	1.114
C=3	.1120	.9100	.1014	.926	.1154	.9109
DD=4	.0856	.8650	.2591	.6869	.7368	.5642
DN=5	.0818	.8155	.2527	.6341	1.297	.4421
E=6	.1094	.7657	.2452	.6358	.9204	.4805
F=7	.05645	.8050	.1930	.6072	1.505	.3662

TABLE 2-2

Power Law Exponents and Coefficients for σy

Atmospheric Stability Class	Downwind Distance, meters $x < 10,000$		Downwind Distance, meters $x \geq 10,000$	
	c	d	c	d
A=1	.495	.873	.606	.851
B=2	.310	.897	.523	.840
C=3	.197	.908	.285	.867
DD=4	.122	.916	.193	.865
DN=5	.122	.916	.193	.865
E=6	.0934	.912	.141	.868
F=7	.0625	.911	.0800	.884

tion of mass requirement for the plume cross section profile. In other words, integrating equation (1) with respect to y with σ_{y_0} substituted for σ_y equals the corresponding value using σ_{y_t} for any value of t. The calculations to show this equality are given in Appendix B.

This method is valid for usual atmospheric conditions, but may not adequately predict concentrations for atypical cases. Two such atypical cases are extremely steady persistent winds for several hours or widely fluctuating light winds in stable atmospheric conditions.

5. Wind Speed. The TEM-8 gives the user the option of inputting one of six wind speed classes or a specific wind speed for each scenario. The wind speed classes are those used by the National Weather Service. The central wind speed [2] of each class is used by the TEM-8. The value for Class 1 wind speed is an arbitrary value to adjust for erroneously reported calms. Values used in the TEM-8 are the ones used in CDM [2], and are listed in Table 2-4.

TABLE 2-4

Values Used in TEM-8 for Wind Speed Classes

NWS Wind Speed Speed Class	Speed Interval, knots	TEM-8 Wind Speed Value, meters/second
1	<3	1.50
2	4-6	2.46
3	7-10	4.47
4	11-16	6.93
5	17-21	9.61
6	>21	12.52

6. Wind Speed Determination. In the lower layers of the atmosphere, wind speed normally increases with height. Most National Weather Service wind speed measurements are taken at a height of 10 meters above the surface and are listed as "ground level" wind speeds. The wind speed at

stack height has the greatest effect on the plume, and this wind speed is normally greater than that at ground level.

The following well-accepted function is used in the TEM-8 to adjust the ground level wind speed to the stack height.

$$U_z = U_o \left(\frac{z}{z_o}\right)^{P(S)} \tag{5}$$

where:

U_z is the wind speed at height z
U_o is the wind speed at anemometer height
z_o is the anemometer height (assumed to be 10 meters)
z is the desired height
P(S) is a function of atmospheric stability Class S with values defined in Table 2-5

TABLE 2-5

Atmospheric Stability Class S	P(S)
A=1	0.10
B=2	0.15
C=3	0.20
DD=4	0.25
DN=5	0.25
E=6	0.30
F=7	0.30

The values of P(S) in Table 2-5 were determined by DeMarrais [11].

In the layer below 10 meters, the surface roughness parameter generally affects wind speed more than atmospheric stability class. Thus, for stacks whose height is less than 10 meters, the wind speed at 10 meters is used. This prevents the use of unrealistically low wind speeds.

7. Plume Rise Determination. Plume rise is determined from equations derived by Briggs [12,13,14,15]. For atmospheric stability Classes A

through D, the neutral/unstable plume rise equations are used. For stability classes E and F, the stable plume rise equations are used. Stack diameter, stack exit velocity, stack exit temperature, and ambient temperature indicate whether the upward motion of the plume is dominated by momentum or thermal buoyancy. There are four different situations for plume rise: (1) stable atmosphere with buoyancy dominated plume, (2) stable atmosphere with momentum dominated plume, (3) neutral/unstable atmosphere with buoyancy dominated plume, (4) neutral/unstable atmosphere with momentum dominated plume. In each situation, except for a stable atmosphere with a momentum dominated plume, plume rise is calculated as a function of downwind distance from the source until the final plume rise is obtained.

The Briggs plume rise equations used in TEM-8 are listed in Figure 2-2.

The atmospheric stability class for each scenario is input to the TEM-8. For each stack, both momentum and buoyancy dominated final plume rises are calculated. The subroutine selects the higher of these two values to reflect whether momentum or thermal buoyancy dominates plume rise. The determination of the appropriate plume rise equation is performed for each scenario. Then, for each stack the plume rise is calculated based upon the selected plume rise equation. The effective stack height, H, is the sum of the stack height, h, and the plume rise Δh.

8. Stack-Tip Downwash. The TEM-8 has an option available to allow one to account for stack-tip downwash effects on effective stack height. This algorithm was developed by Gifford [16].

When the stack exit velocity, V_s is less then 1.5 times the horizontal wind speed at stack height, U, the stack-tip downwash correction

	Stable Atmosphere	Neutral/Unstable Atmosphere
Buoyancy Dominated	$\Delta h(x) = 1.6F^{1/3} x^{2/3} U^{-1}$ (6) or $\Delta h_{MAX} = 2.6(F/Us)^{1/3}$ (7) where $s = 0.02g/T_A$ for E stability $s = 0.035g/T_A$ for F stability For sources located in Texas $s = 0.018g/T_A$ for E stability $s = 0.025g/T_A$ for F stability	$\Delta h(x) = 1.6F^{1/3} x^{2/3} U^{-1}$ (6) for $x < 3.5x^*$ or $\Delta h_{MAX} = 1.6F^{1/3}(3.5x^*)^{2/3} U^{-1}$ (8) for $x > 3.5x^*$ where $x^* = 14F^{5/8}$ if $F < 55$ $x^* = 34F^{2/5}$ if $F > 55$
Momentum Dominated	$\Delta h_{MAX} = 1.5(VR)^{2/3} U^{-1/3} s^{-1/6}$ (9) where s is defined as above	$\Delta h(x) = 3.78\left(\frac{V^2}{U(V+3U)}\right)^{2/3}\left(\frac{xR^2}{2}\right)^{1/3}$ (10) or $\Delta h_{MAX} = 3VD/U$ (11)

$F = gVR^2(T - T_A)/T$

T = source temperature, °K

T_A = ambient temperature, °K

V = stack exit velocity, m/s

R = stack radius, m

D = stack diameter, m

x = downwind distance, m

U = wind speed at physical source height, m/s

g = acceleration due to gravity 9.8 m/s^2

Δh = plume rise, m

Δh_{MAX} = final plume rise, m

Figure 2-2 Plume Rise Formulae

term, C, is defined as:

$$C = 4(1.5 - \frac{V}{U})\ R$$

where:

R is the stack radius, meters
U is the wind speed at stack height, meters/second
V is the stack exit velocity, meters/second

The value for C is subtracted from the effective stack height.

9. Calculations from Tabular Data. For each source-receptor combination, the TEM-8 is able to calculate values for equation (1) very rapidly. The calculation uses a numerical technique developed by Christiansen and Porter [1] that was first used in the Texas Climatological Model. Let

$$K_y(x,y,S,t) = \frac{1000}{\dfrac{\sigma_y}{\left(\frac{10}{t}\right)^{R(S)}}} \exp\left[-\frac{y^2}{\left[\dfrac{\sigma_y}{\left(\frac{10}{t}\right)^{R(S)}}\right]^2}\right] \qquad (12)$$

where:

x is the downwind distance
y is the crosswind distance
S is the atmospheric stability class
R(S) is a function of S as defined in Table 2-3
t is the time averaging period in minutes

Note that values of t for use in the TEM-8 are limited to 10, 30, 60, and 180 minutes.

The crosswind angle, Δ, is defined as the angle between wind direction azimuth and the azimuth from the source to the receptor. The formulation for Δ is

$$\Delta = \text{arc tan}\ \frac{y}{x} \qquad (13)$$

If equation (13) is rewritten as

$$y = x \tan \Delta \tag{14}$$

and substituted into equation (12), then

$$K_y(x,y,S,t) = \frac{1000}{\dfrac{\sigma_y}{\left(\frac{10}{t}\right)^{R(S)}}} \exp\left[-\frac{(x \tan \Delta)^2}{\left[\dfrac{\sigma_y}{\left(\frac{10}{t}\right)^{R(S)}}\right]^2}\right] \tag{15}$$

Note that K_y is a function of x, Δ, S, t.

Let

$$K_z\ (x,H,S) = \frac{1000}{\pi\sigma_z} \quad \exp\left[-\frac{H^2}{2\sigma_z{}^2}\right] \tag{16}.$$

where H is effective stack height and the other variables are as defined in equation (12). So, K_z is a function of x, H, and S. Then from equations (1), (4), (15) and (16)

$$\chi(x,y) = \frac{QKy\ (x,\Delta,S,t) \quad K_z\ (x,H,S)}{U} \tag{17}.$$

K_y and K_z were calculated using selected values for t, x, Δ, H, and S. Calculations for K_y were made using 20 values for downwind distance x, eight values for crosswind angle Δ, seven values for atmospheric stability Class S, and four values for averaging time t. The eight values used for Δ were a function of atmospheric stability class and time averaging period where

$$\Delta = i\delta,\ i=0,1,2,3,4,5,6,7$$

and δ is defined in Table 2-6.

TABLE 2-6

Crosswind Sector Values

Atmospheric Stability Class	Time Averaging Period, minutes	δ, Degrees	Maximum Value for Δ, Degrees
A	10	5.0	35.0
	30	7.2	50.4
	60	9.0	63.0
	180	10.9	76.3
B	10	4.0	28.0
	30	5.5	38.5
	60	7.1	49.7
	180	9.3	65.1
C	10	3.0	21.0
	30	3.7	25.9
	60	4.7	32.9
	180	6.5	45.5
D-day and D-night	10	2.0	14.0
	30	2.2	15.4
	60	2.7	18.9
	180	3.6	25.2
E	10	1.5	10.5
	30	1.5	10.5
	60	1.7	11.9
	180	2.0	14.0
F	10	1.0	7.0
	30	1.0	7.0
	60	1.1	7.7
	180	1.3	9.1

Values for δ were selected so that for any downwind distance, the concentration at a crosswind angle of 7δ would be less than or equal to one percent of the corresponding centerline concentration.

For example, with atmospheric stability Class C and a 10 minute time averaging period, the values for Δ are 0°, 3°, 6°, 9°, 12°, 15°, 18°, and 21°; for atmospheric stability Class A with a 60 minute time averaging period, the values for Δ are 0°, 9°, 18°, 27°, 36°, 45°, 54°, and 63°.

The calculated K_y values for each of the 4480 (20x8x7x4) different combinations of variables are stored in data tables in the TEM-8. The specific values of variables used for calculation of K_y values are shown in Table 2-7. K_y values are stored in four tables based upon the time averaging period. These are denoted as K_y1, K_y2, K_y3, and K_y4 tables for 10 minute, 30 minute, one hour, and three hour averaging times respectively. At the beginning of the program run, the appropriate tabular values for $K_y(x,\Delta,S,t)$ are loaded into $K_y(x,\Delta,S)$. For retrieval purposes, subscripts for K_y values are i, j, and k.

Similarly, for calculation of K_z, 20 values for downwind distance x, 14 values for effective stack height H, and seven values for atmospheric stability Class S were used. The calculated values for each of the 1960 (20x14x17) different combinations are also stored in data tables in the TEM-8. The specific values of variables used for calculation of K_z values are shown in Table 2-8. For retrieval purposes, subscripts for K_z values are i, j, k.

For downwind distances less than 2.0 kilometers, the TEM-8 calculates explicitly point source contributions at each receptor using equation (1).

TABLE 2-7

Variables Used to Calculate Values of K_y Stored in TEM-8 Data Tables

Nomenclature	Time, Minutes	Index, i	Downwind Distance, x,km	Index, j	Crosswind Angle, Δ,°	Index, k	Stability Class, S
K_y1	10	1	2	1	0	1	A
K_y2	30	2	3	2	δ	2	B
K_y3	60	3	4	3	2δ	3	C
K_y4	180	4	5	4	3δ	4	D day
		5	6	5	4δ	5	D night
		6	7	6	5δ	6	E
		7	8	7	6δ	7	F
		8	10	8	7δ		
		9	12				
		10	14				
		11	17				
		12	20				
		13	23				
		14	27				
		15	31				
		16	36				
		17	41				
		18	47				
		19	53				
		20	60				

TABLE 2-8

Variables Used to Calculate Values of K_z Stored in TEM Data Tables

Index, i	Downwind Distance, x,km	Index, j	Effective Stack Height, H,m	Index, k	Stability Class, S
1	2	1	10	1	A
2	3	2	20	2	B
3	4	3	30	3	C
4	5	4	50	4	D day
5	6	5	70	5	D night
6	7	6	100	6	E
7	8	7	150	7	F
8	10	8	200		
9	12	9	300		
10	14	10	450		
11	17	11	700		
12	20	12	1000		
13	23	13	1400		
14	27	14	2000		
15	31				
16	36				
17	41				
18	47				
19	53				
20	60				

For downwind distances greater than 2.0 kilometers, the TEM-8 calculates point source contributions at each receptor using equation (17). Values for K_y and K_z are determined by linear interpolation from values of K_y and K_z stored in the data tables.

For downwind distances greater than 2.0 kilometers it is valid to assume that final plume rise has been reached and thus the effective stack height will be constant. This assumption is used in interpolation of values for K_z.

For calculation of K_z values in the data tables, the smallest value for effective stack height is 10 meters and the largest value is 2000 meters. Sources with effective stack heights less than 10 meters are assigned an effective stack height of 10 meters and those whose effective stack height exceeds 2000 meters are assigned an effective stack height of 2000 meters.

The maximum downwind distance used for calculation of K_y and K_z values is 60 kilometers. Sources that are located in excess of 60 kilometers upwind of a receptor are disregarded.

For determination of K_y, one must first consider the time averaging period t. Then K_y is found by interpolation of values listed in the appropriate data table.

For calculation of K_y values, eight values for Δ were used based upon atmospheric stability class and time averaging period. For a source-receptor combination, if the crosswind angle exceeds the largest angle for which K_y values were calculated, the source contribution is neglected. Thus, source contributions are considered only for receptors that fall within an angular sector on either side of the plume centerline. For each case the value of this angular sector is given in Table 2-6.

An example of a typical case of interpolation is included. In this case, let the time averaging period be 30 minutes with an atmospheric stability class of C and an effective stack height of 55 meters. A receptor is selected that is 16 kilometers downwind from the source with a crosswind angle of 17°. Values from the K_y2 tables (representing a 30 minute time averaging period) are loaded into the storage location for $K_y(i,j,k)$. For the downwind distance x, values for K_y at 14 and 17 kilometers are listed in the data tables. From Table 2-6 the value for δ is 3.7°. Table entries are listed for Δ values of 0°, δ=3.7°, 2δ=7.4°, 3δ=11.1°, 4δ=14.8°, 5δ=18.5°, 6δ=22.2°, and 7δ=25.9°. Thus, K_y is determined by interpolation of K_y2 data table entries $K_y2(10,4,3)$, $K_y2(10,5,3)$, $K_y2(11,4,3)$, and $K_y2(11,5,3)$. See Table 2-7 for the correspondence between $K_y2(i,j,k)$ and values for t, x, Δ, and S. The effective stack height of 55 meters lies between 50 and 70 meters for which table entries are listed. There are listings for downwind distances of 14 and 17 kilometers. Then the K_z value is determined by interpolation of data table entries $K_z(10,4,3)$, $K_z(10,5,3)$, $K_z(11,4,3)$, and $K_z(11,5,3)$. See Table 2-8 for the correspondence between $K_z(i,j,k)$ and values for x, H, and S.

10. Limited Vertical Mixing. The turbulent air near the ground is frequently bounded above by a layer of stable air. The distance from the ground to the bottom of the stable layer is called the mixing height, L. This stable layer effectively limits vertical dispersion to the mixing layer.

If vertical mixing is limited, pollutants emitted into the mixing layer will be trapped and at some point downwind will become uniformly mixed in the vertical. To predict this behavior, the TEM-8 uses the method suggested by Turner [3]. If one sets $2.15\sigma_z$ equal to L, the mixing height, then $\sigma_z=0.47L$. Define x_m as the downwind distance which gives a value of $\sigma_z=0.47L$. Then it is assumed that vertical mixing is uniform throughout the mixing layer at a downwind distance of $2x_m$. It can be shown (See Appendix C) that for any given downwind distance greater than $2x_m$ and for any crosswind distance, the average concentration is

$$\chi(x,y) = \frac{Q10^6}{\sqrt{2\pi}\left[\dfrac{\sigma_y}{\left(\frac{10}{t}\right)^{R(S)}}\right]LU} \exp\left[-\frac{y^2}{2\left[\dfrac{\sigma_y}{\left(\frac{10}{t}\right)^{R(S)}}\right]^2}\right] \qquad (18)$$

Then from equation (15):

$$\chi(x,y) = \frac{Q\ K_y(x,y,S)}{U}\ \frac{1000}{\sqrt{2\pi}L} = \frac{Q\ K_y(x,\Delta,S)}{U}\ \frac{1000}{\sqrt{2\pi}L}$$

Comparing with equation (17), one can obtain the same by setting

$$K_z(x,H,S) = \frac{1000}{\sqrt{2\pi}L} \qquad (19)$$

which is independent of x, H, and S.

To calculate the concentration for downwind distances greater than $2x_m$, the value of K_z found by equation (19) is used in equation (17). Equation (17) is used to calculate concentrations for downwind distances less than x_m. To determine concentrations at downwind distances between x_m and $2x_m$, equation (17) is used with the K_y value for the receptor and an interpolated K_z value. This K_z value is determined by linear interpolation between the K_z value from equation (19) and the K_z value for downwind distance x_m.

There are three cases to consider when there is a limit to vertical mixing. The first is when the effective stack height is less than the mixing height. In this case, stack pollutants are emitted into the limited mixing layer.

In the second case, the physical stack height exceeds the mixing height. Stack pollutants are emitted into the stable layer above and are not mixed within the mixing layer. Thus, these pollutants will not be brought to ground level and the source is neglected.

The third case occurs when the physical stack height is less than the mixing height, but the effective stack height exceeds the mixing height. Whether the plume escapes the mixing layer depends upon how high the effective stack height is above the top of the mixing layer and upon the strength of the inversion. A strong inversion layer can truncate plume rise and cause the plume to be trapped in the mixing layer. An upper level inversion layer is more stable than the mixing layer, so the plume's thermal buoyancy will quickly decrease with height, resulting in a rapid end to plume rise.

The TEM-8 simulates the effect caused by inversions of various strengths by defining an inversion penetration factor, I. The value for I is an input option with a default value of 2.0. The weakest inversion uses I=1. If the effective stack H exceeds I•L, then it is assumed that the plume escapes the mixing layer and the source is neglected. If H exceeds L, but H is less than or equal to I·L, then it is assumed that the plume is trapped in the mixing layer and H is set equal to L.

11. Pollutant Decay. There are many mechanisms that remove or alter airborne pollutants. Examples are absorption and chemical reaction. A simple way to approximate the effect of atmospheric depletion mechanisms is to assume that the decay is an exponential function of time. That is

$$\chi_t = \chi_o \exp(-at) \qquad (20)$$

where:

χ_t is the pollutant concentration at time t
χ_o is the pollutant concentration without decay
a is a suitable constant
t is the time since release of the pollutant in seconds.

A half-life for the pollutant may be used to determine values for the constant in equation (20). Then

$$a = \frac{0.692}{t_{1/2}} \qquad (21)$$

where $t_{1/2}$ is the pollutant half-life in seconds.

Furthermore, t can be determined by

$$t = \frac{x}{U} \qquad (22)$$

where:

x is downwind distance in meters
U is average wind speed at release point in meters/second

Combining equations (20), (21), and (22)

$$\chi_t = \chi_0 \exp\left(-\frac{0.692x}{U\, t_{1/2}}\right)$$

For TEM-8 calculations, half-life values are input for each pollutant in each scenario. This will allow the user to change half-life values if they are a function of meteorological conditions. To save computation time, twenty decay factors are calculated for each pollutant and for each scenario. The distances used are those used for determination of K_y and K_z and are listed in Table 2-7. Since the decay factor does not normally change rapidly with distance, there is no interpolation between the twenty calculated values. Thus, the decay multiplier remains constant between the tabular values for downwind distance.

12. Restriction of Receptors for Calculations. In most modeling situations, pollutants from each source will not impact upon all receptors in the grid. These receptors include those that are located upwind of the source, too far from the plume centerline, or more than 60 kilometers downwind of the source. The TEM-8 uses a method to identify unaffected receptors. For each source and each scenario, a rectangular area of receptors is chosen and calculations for that set of conditions are restricted to those chosen receptors. Outside of that area of receptors, the source contribution is considered to be zero. Inputs for this determination are source coordinates, grid boundaries, wind direction, and crosswind angle. As mentioned in paragraph 2.2.1.9, the crosswind angle is a function of atmospheric stability class and time averaging period. Three pictorial examples of the selected receptor area are shown in Figure 2-3.

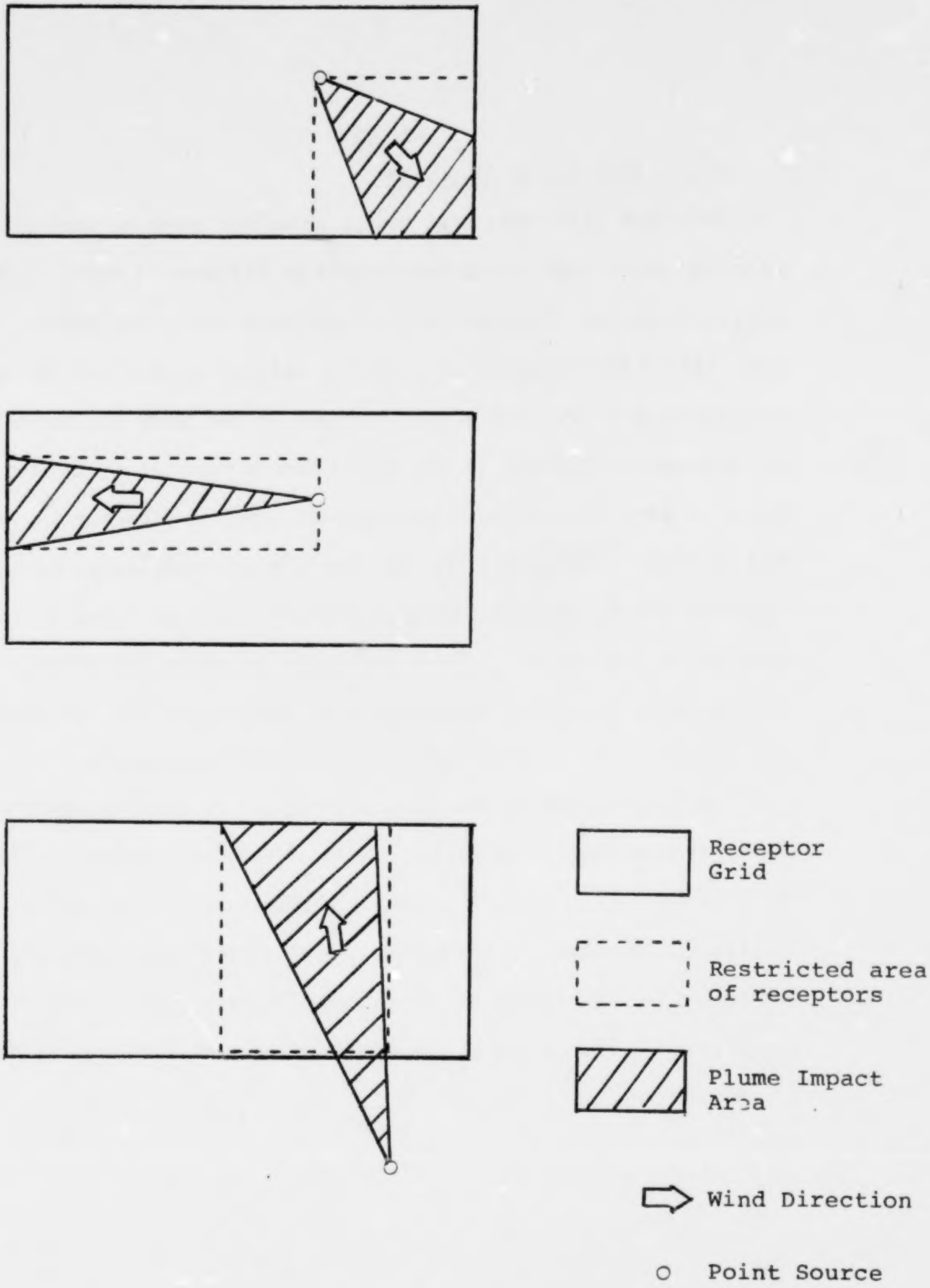

Receptor Grid
Restricted area of receptors
Plume Impact Area
Wind Direction
Point Source

Figure 2-3. Restriction of Receptors for Calculations

2.2.2 Area Source Algorithms

The TEM-8 calculates area source pollutant contributions with an algorithm based upon a method developed by Gifford and Hanna [17]. For area sources, the TEM-8 performs a coordinate axis translation. The new grid, called the "calculation grid", is defined by shifting the receptor grid one-half of the grid square distance to the South and one-half of the grid square distance to the West. Then a receptor is located at the center of each calculation grid square as shown in Figure 2-4. Note that receptor grid squares are the same size as calculation grid squares. Each area source should be sized so that it covers an integral number of calculation grid squares. It is advisable to define the receptor grid squares, and hence, the calculation grid squares, so that the smallest area source is at least as large as a receptor grid square.

The relationship between area sources and calculation grid squares can be divided into three cases. In the first case, the area source is the size of a calculation grid square. Emissions are assumed to be located at the center of the square. Area source contributions are determined for the center of the calculation grid square (at a receptor) containing the source and at the center of each of four squares downwind of the source.

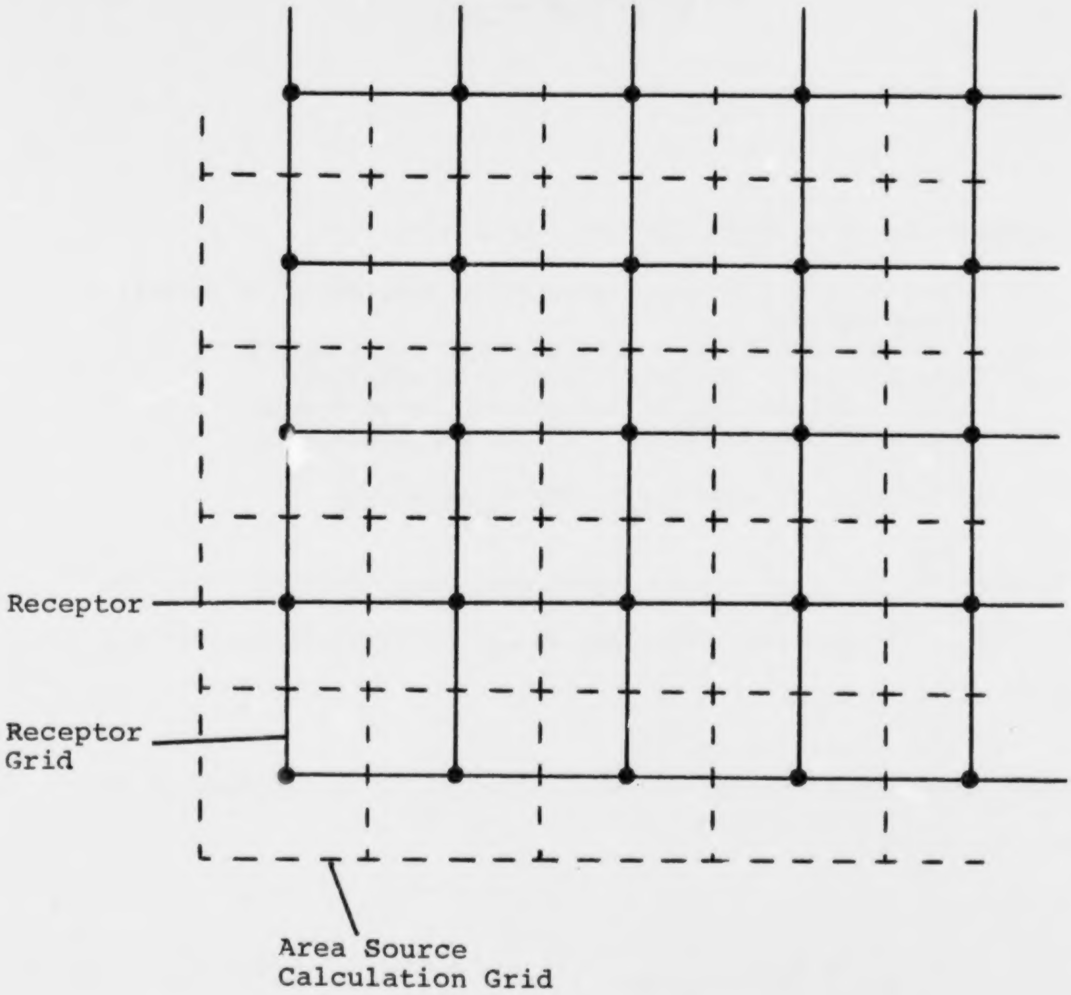

Receptor
Receptor Grid
Area Source Calculation Grid

Figure 2-4. Relationship Between Receptor Grid and Area Source Calculation Grid

The equation for the pollutant concentration in the center of the square containing the area source is

$$X = \sqrt{\frac{2}{\pi}}\,\frac{Q\ (\Delta x/2)^{1-b(S)}}{U_0\ a(S)\ [1-b(S)]} \qquad (23)$$

The symbols used in equation (23) are listed below.

U_0 is the surface wind speed (measured at a height of 10 meters) in meters/second
Δx is the receptor (calculation) grid spacing in meters
$a(S)$ and $b(S)$ are functions of atmospheric stability Class S. Values used in this calculation were determined by Gifford and Hanna [17] and are reported in Table 2-9.
Q is the area source emission rate in gm/km^2/sec.

To better simulate urban surface conditions, the atmospheric stability class index (for each stability class except for Class A) has been decreased by one.

The pollutant concentration in the ith (i=1,2,3,4) square downwind of the area source is:

$$x = \sqrt{\frac{2}{\pi}}\,\frac{Q\ (\Delta x/2)^{1-b(S)}}{U_0\ a(S)[1-b(S)]}\ \left[(2i+1)^{1-b(S)} - (2i-1)^{1-b(S)}\right] \qquad (24)$$

All symbols are as defined in equation (23) above. The derivation of equations (23) and (24) is shown in Appendix D.

TABLE 2-9

Values for a(S) and b(S) Used in Equations (23) and (24)

Atmospheric Stability Class*	a(S)	b(S)
A=1	0.4	0.91
B=2	0.4	0.91
C=3	0.33	0.86
DD=4	0.22	0.80
DN=5	0.15	0.75
E=6	0.06	0.71
F=7	0.06	0.71

*For all classes except Class A, the stability class index has been decreased by one (1) to better simulate urban surface conditions.

As shown in Figure 2-5, the location of the four downwind squares is not apparent in cases when the wind direction is not parallel to one of the calculation grid coordinate axes. The angle between the wind azimuth and the nearest calculation grid coordinate axis is defined as ξ, so $0° \leq \xi \leq 45°$. TEM-8 considers ten ranges of values for ξ as shown in Table 2-10. For each range of ξ, the location of the four downwind squares is shown in Figure 2-5. For each value of ξ the location of each downwind square is indicated by i, the number of calculation grid squares downwind from the area source and by j, the number of calculation grid squares from the axis used to define ξ. In all cases, the square covered by the area source has i=0 and j=0. For each value of i, values for j depend upon the value for ξ, as shown in Figure 2-5. The values for j are summarized in Table 2-10. These patterns of squares are stored in TEM-8 data tables that list values of i and j as shown in Table 2-10. For a given scenario, each area source will have the same spatial pattern of affected squares downwind.

In the second case the area source is larger than one of the calculation grid squares. Let m be the number of calculation grid squares covered by the area source. Then the emissions, Q, from the source are divided into m component emission rates, Q_j defined by:

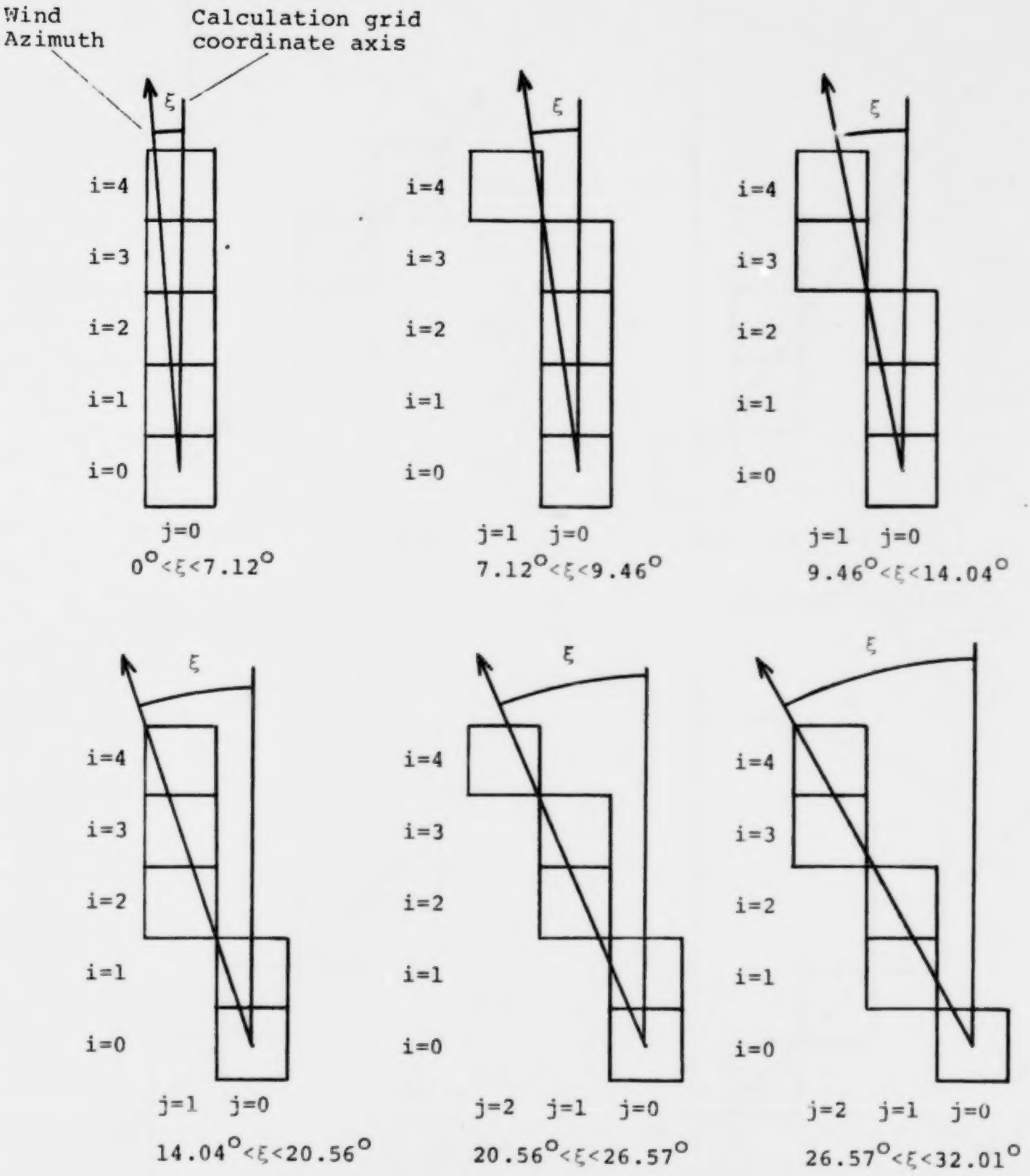
$$Q_j = Q \frac{A_j}{A} \qquad j = 1,2,\ldots, m$$

where:

A_j is the area of the source contained in the jth square and

$$A = \sum_{j=1}^{m} A_j.$$

Note that $Q = \sum_{j=1}^{m} Q_j$.


Wind Azimuth
Calculation grid coordinate axis
ξ
i=4
i=3
i=2
i=1
i=0
j=2
j=1
j=0

$0^\circ < \xi < 7.12^\circ$

$7.12^\circ < \xi < 9.46^\circ$

$9.46^\circ < \xi < 14.04^\circ$

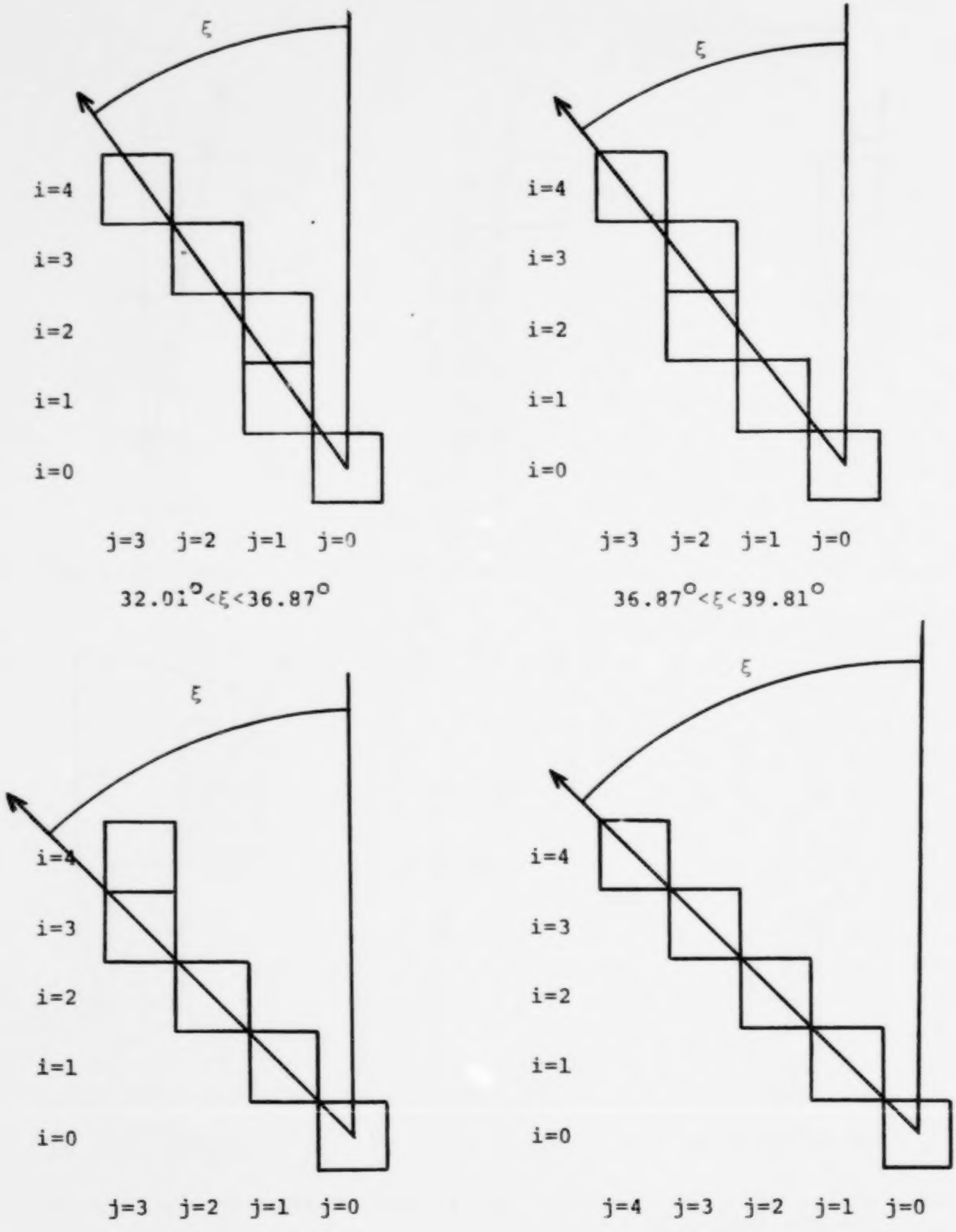
$14.04^\circ < \xi < 20.56^\circ$

$20.56^\circ < \xi < 26.57^\circ$

$26.57^\circ < \xi < 32.01^\circ$

Note: Calculation grid squares are shown. A receptor is located in the center of each square

Figure 2-5 Spatial Patterns of Affected Sources Downwind of an Area Source


ξ
i=4
i=3
i=2
i=1
i=0
j=4
j=3
j=2
j=1
j=0

$32.01^{\circ}<\xi<36.87^{\circ}$

$36.87^{\circ}<\xi<39.81^{\circ}$

$39.81^{\circ}<\xi<41.19^{\circ}$

$41.19^{\circ}<\xi<45^{\circ}$

Figure 2-5 continued

TABLE 2-10

Values of i and j for Each Spatial Pattern of Affected Squares Downwind of an Area Source

ξ range, degrees	Values for j**				
	i=0*	i=1	i=2	i=3	i=4
0 - 7.12	0	0	0	0	0
7.12 - 9.46	0	0	0	0	1
9.46 - 14.04	0	0	0	1	1
14.04 - 20.56	0	0	1	1	1
20.56 - 26.57	0	0	1	1	2
26.57 - 32.01	0	1	1	2	2
32.01 - 36.87	0	1	1	2	3
36.87 - 39.81	0	1	2	2	3
39.81 - 41.19	0	1	2	3	3
41.19 - 45.00	0	1	2	3	4

*i is the number of calculation grid squares downwind from the area source

**j is the number of calculation grid squares from the axis used to define ξ

For each value of ξ, a diagram of the downwind squares is shown in Figure 2-5.

Then the contributions from each of the m squares are determined as it was done with a single square.

It is possible to have a small area source imbedded in a larger area source. For each source the emission rate is divided into components for each covered square as described above. Then each square is considered as an area source with an emission rate equal to the sum of the component emission rates from the original area sources.

2.3 SPECIAL SOURCE APPLICATIONS

There are a number of sources that have characteristics that do not satisfy all of the assumptions used in the algorithms covered in Sections 2.1 and 2.2.

Described below are methods that allow the use of the TEM-8 to predict pollutant dispersion from two such types of sources.

2.3.1 Flares

Flares are normally elevated sources but they do not behave exactly like point sources. If a flare is to be treated as a point source, determination of all stack parameters is not possible. Since combustion occurs at or beyond the flare tip in the atmosphere, appropriate values for stack temperature and stack velocity cannot be determined. The diameter of pipe leading to the flare tip is not a factor in determining plume rise.

In order to use the TEM-8 to predict dispersion from flares, the point source algorithm is used with arbitrary values assigned for the stack velocity and stack temperature. At present the Texas Air Control

Board uses a stack velocity of 20 m/s and a stack temperature of 1000°C. Then the effective stack diameter is determined by

$$D = \sqrt{10^{-6} q_n}$$

where:

$$q_n = q(1 - 0.048\sqrt{MW})$$

and

q is the gross heat release in cal/sec
MW is the weighted (by volume) average molecular weight of the mixture being burned.

The derivation of the value for D is shown in Appendix E. Note that q_n accounts for heat loss due to radiation. The value used was determined by Tan [18].

2.3.2 Small, Strong Area Sources

For the area source algorithm described in Section 2.2, the following assumptions are made: the source emission rate is uniform throughout the source, the emission rate is small, and the source covers a large area which is at least as large as one of the grid squares. Examples of area sources that meet these criteria are: parking lots, roads in a large area, lagoons, and residential space heating in a large area. The algorithm does not properly describe the dispersion of small sized area sources with moderate or high pollutant emission rates. Examples of these sources are: rock crushers, transfer point for conveyors, screening operations, and small storage piles. Emissions from these sources behave much like those from a point source but there are no identifiable stack parameters. The best way to use the TEM-8 to predict pollutant dispersion from such sources is to treat the source as a point source. Arbitrary values are used for stack velocity, stack diameter, and stack temperature. These parameters determine plume rise, which is negligible for such sources. Values used by the Texas Air Control Board to produce zero plume rise are: stack velocity 0.0 m/s, stack diameter 1 m, and stack temperature 0°C. The run will be automatically terminated if a stack diameter of zero is input. The elevation of the point of pollutant release above ground is used for the stack height. A sample TEM-8 program run for the same small, strong area source is shown in Appendix G. Results obtained with this method can be compared to those obtained with the area source algorithm.

2.4 RECEPTOR ARRAY

2.4.1 Description of Receptor Grid

The TEM-8 calculates pollutant concentrations at each receptor in the rectilinear receptor array defined by the user. A maximum of 2500 receptors may be used with a maximum number of 50 rows and 50 columns. The spacing between each row and column is uniform and is defined by the user. Receptors are located on the intersections of grid rows and columns. The grid spacing, number of rows, number of columns, and coordinates of the receptor at the southwest corner of the grid are used to define the grid. Point and area sources do not necessarily need to be located within the grid boundaries.

If area sources are included in the source inventory, the grid spacing should be selected so that the smallest area source is the same size as a grid square. For computations involving area sources, a calculation grid is defined with grid squares the same size as receptor grid squares, but with a receptor located in the center of each calculation grid square. For details, see Section 2.2.2 and Figure 2-4.

2.4.2 Automatic Grid Selection Option

The TEM-8 has an optional subroutine which will automatically select a receptor grid for each scenario. The size and location of grids for different scenarios will normally differ since the selection of the receptor grid is based upon wind speed, wind direction, and atmospheric stability class.

Each source is examined sequentially. Two orthogonal axes are used with the origin located at the origin of the coordinate system for the point sources. The x axis is oriented in the north-south direction with positive values in the northerly direction. The y axis is oriented in the east-west direction with positive values in the easterly direction. Angle E is defined by

$$E = 90° - W$$

where W is the wind direction.

The axes are rotated through angle E. The wind then blows down the x axis.

The distance to the point of maximum concentration, x_{m_2}, is determined by

$$x_{max} = \left[\frac{b(S)\ H^2}{a(S)^2[d(S)+b(S)]}\right]^{\frac{1}{2b(S)}} \qquad (26)$$

where:

H is the effective stack height
a(S), b(S) and d(S) are functions of atmospheric stability Class S and are defined in Table 2-9.

The derivation of equation (26) was done by Pewitt [18] and is shown in Appendix E. Equation (26) is also used to determine x_{m_1}, the point of maximum concentration using the physical stack height. Then let

$$XTM(1) = XT + x_{m_1} \text{ and}$$

$$XTM(2) = XT + x_{m_2}$$

where:

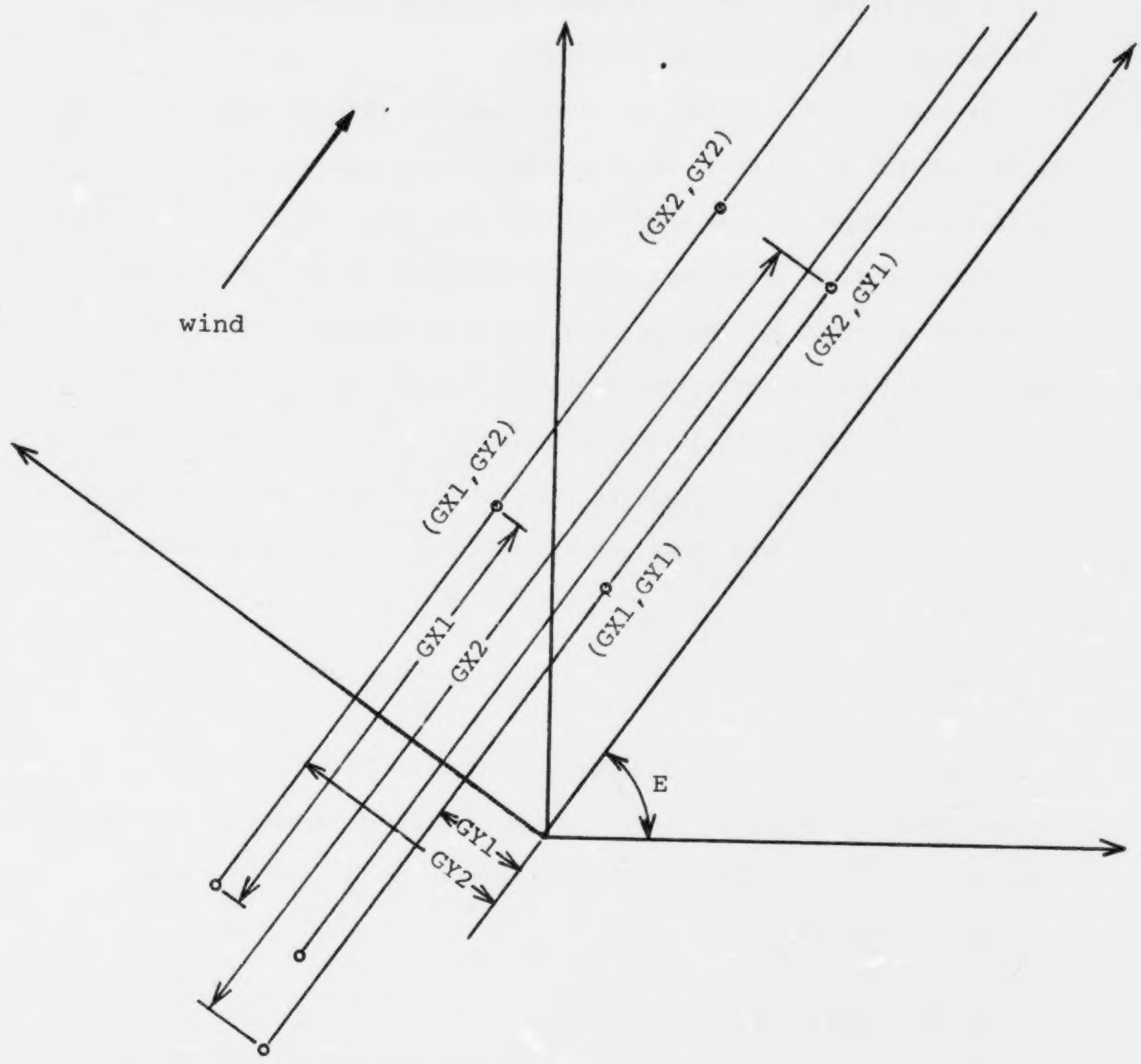
XT is the x coordinate of the point source in the rotated coordinate system.

The largest value of XTM(2) for all point sources is GX2 and the smallest value of XTM(1) for all point sources is GX1. Let YT be the y coordinate of the point source in the rotated coordinate system. Then GY2 is the largest value of YT for all point sources and GY1 is the smallest value of YT for all point sources. These points are illustrated in Figure 2-6.

Next, the points (GX1, GY1), (GX2, GY1), (GX2, GY2) and (GX1, GY2) are rotated back to the original coordinate system. The largest of the four x values and the largest of the four y values are chosen for the coordinates of the northeast corner of the grid. The smallest of the four x values and the smallest of the four y values are chosen for the coordinates of the southwest corner of the grid.

Then XT is defined as the distance between the x coordinates of the grid corners and YT is the distance between the y coordinates of the grid corners. Let Δmax be the larger of XT and YT. Then Δmax is used to determine the number of columns and rows in the receptor grid and the grid spacing. If Δmax is larger than 10 kilometers, then the number of rows (columns) is 50 and the grid spacing is XT/50 (YT/50) km. If 10 km>Δmax>5 km, then a grid spacing of 0.2 km is used and the number of rows (columns) is XT/0.2 (YT/0.2).

If 5 km>Δmax>0.25 km, then the number of rows (columns) is 25 and the grid spacing is Δmax/25 km.


wind
(GX2,GY2)
(GX2,GY1)
(GX1,GY2)
(GX1,GY1)
GX1
GX2
GY1
GY2
E

o emission source

Figure 2-6. Points Used For Selection of Receptor Grid By AUTOGRD Subroutine

If $\Delta max < 0.25$ km, the grid spacing is 0.01 km, the smallest possible, and the number of rows (columns) is XT/0.01 (YT/0.01).

A typical example of the receptor grid selected by the automatic grid option is illustrated in Figure 2-7.

If the culpability list option is used, the receptor grid is limited to 25 rows and 25 columns. In this case the grid spacing is increased so that the number of rows and/or columns does not exceed 25.

This algorithm develops a receptor grid that is suitable for use with point sources, but does not consider area sources. The chosen receptor grid may not be suitable if area sources are included in the inventory. If the source inventory includes area sources, the receptor grid should be defined so that the smallest area source covers at least one grid square and that there are at least four receptors downwind of each source.

2.5 TEM-8 LIMITATIONS

Some limitations associated with assumptions made in various parts of the TEM-8 are discussed below. These limitations should be considered when comparing pollutant concentrations predicted by the TEM-8 with measured concentrations.

2.5.1. Steady State Assumption

Steady state conditions are assumed when the Gaussian dispersion equation is used. Concentration predictions are not as accurate when source or atmospheric behavior does not follow these steady state assumptions. Various aspects of these assumptions are discussed in detail.

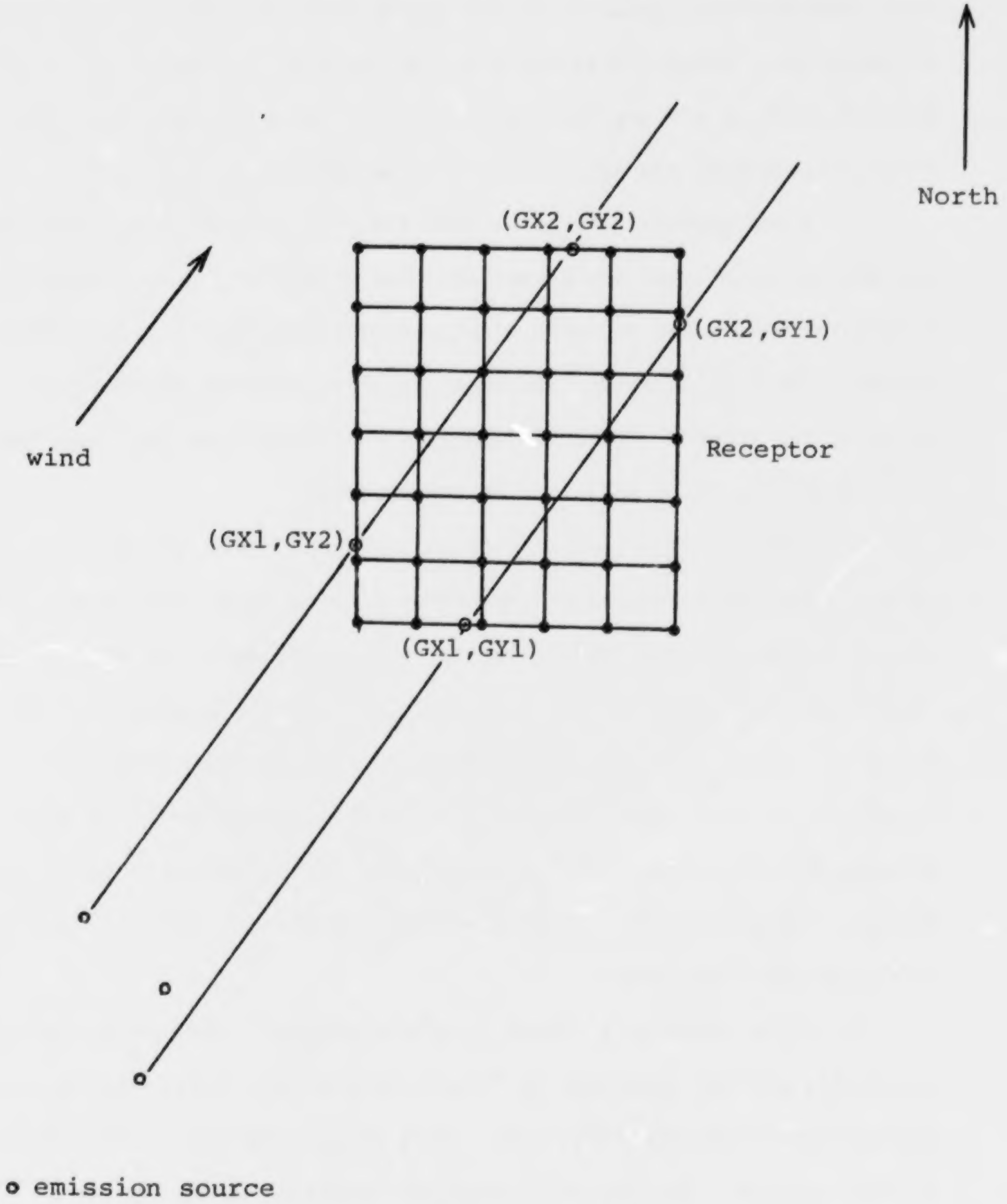

North
(GX2,GY2)
(GX2,GY1)
wind
Receptor
(GX1,GY2)
(GX1,GY1)
o emission source

Figure 2-7. Example of Receptor Grid Selected by AUTOGRD Subroutine

1. Source emission rates for use in the TEM-8 are based upon mean emission rates. But short term emission rates may fluctuate, so pollutant concentrations downwind of the source will also exhibit corresponding fluctuations. These fluctuations can be large if the source is intermittent, such as a flare that functions only for a few days each year. These fluctuations are not included in the TEM-8.

2. A homogeneous horizontal wind field is assumed, i.e., there is one average wind speed and a constant wind direction. In actuality, the horizontal wind speed and wind direction will vary over a short time period. TEM-8 calculations are most sensitive to these fluctuations close to the source. These horizontal wind fluctuations may cause the TEM-8 to over-predict pollutant concentrations.

3. Wind direction and wind speed will change with an increase in height. The TEM-8 calculates the change in wind speed with height. The same algorithm is used for all locations, but the amount of wind speed change can vary with location based in part upon the roughness of the terrain. No provision has been made to account for wind direction change due to wind shear. The effects of these changes will be most pronounced when effective stack heights are high and receptors are very distant from the source. Complex (rough) terrain can also affect wind direction and wind speed.

4. After there is a change in wind direction, remnants of the previously emitted plume may be blown back over the source and increase downwind pollutant concentrations. This is most evident shortly after frontal passage. The possibility of this addition to the downwind pollutant concentration is not accounted for in the steady state assumptions.

5. One of the steady state assumptions is that emissions from pollutants are transported to the receptor from all sources located up to 60 kilometers upwind of the receptor. It is also assumed the meteorological conditions do not change during the time it takes the plume to travel to the receptor. In many cases this is a reasonable assumption, especially if one is interested in predicting pollutant concentrations for the worst case. The user should be careful to be sure that the meteorological conditions can be expected to persist as long as required for cases where long transport times are necessary for the plume to reach the receptors of interest. These remarks are especially important when using low wind speeds with stable atmospheric stability classes.

2.5.2. Dispersion Coefficients

The values for the dispersion coefficients used in the TEM-8 were obtained from power law curve fits to the curves of these coefficients given by Pasquill, Gifford and Turner [3]. It is possible to obtain better fits to these curves, but for comparative purposes, the curve fits used in the CDM were used. The curves given by Pasquill, Gifford and Turner were developed for gently rolling terrain and may not accurately approximate values for complex terrain or for urban areas. Thus, in these cases TEM-8 predictions may not compare favorably with measured concentrations. The original data upon which these coefficients were based was not collected for distances in excess of one kilometer, so the curves were extrapolated for greater distances. Hence, values obtained in the extrapolated zone may not be as accurate as values for distances less than one kilometer. These curves are not defined for distances closer than 100 meters to the source. The seven Pasquill-Gifford atmospheric stability classes are used to categorize all atmospheric conditions. There are cases that may not fit well into any of these seven classes, hence, dispersion for these meteorological conditions may not be adequately approximated by the TEM-8.

2.5.3. Downwash

The TEM-8 has an option to determine stack-tip downwash, but downwash caused by nearby buildings or other terrain features is not considered. Downwash caused by nearby terrain and buildings can alter measured concentrations with the largest changes coming close to the stack. The TEM-8 does not account for other forms of atmospheric turbulence such as mechanical turbulence generated by buildings upwind and thermal turbulence caused by an urban heat island or other large areas of heat flux.

2.5.4. Terrain Adjustment

The TEM-8 does not make an adjustment for differences in terrain elevation between sources and/or receptors. In cases where the elevation of a receptor changes relative to that of the source or other receptors, a change in pollutant concentration can be expected. In particular, the plume could reach ground level closer to the source if the downwind receptors are elevated with respect to the source. In this case, the TEM-8 would predict lower concentrations than a model with terrain elevation adjustment.

Meteorological effects caused by the air crossing complex (rough) terrain are not accounted for in the TEM-8. In some cases, these effects can substantially alter measured pollutant concentrations and the location of affected receptors.

2.5.5. Pollutant Depletion

The TEM-8 is based upon algorithms developed for non-reactive pollutants. An option does allow one to approximate exponential pollutant decay, but this method is dependent upon an accurate estimate of the pollutant's half-life. Extreme care should be exercised by the user when interpreting results from the TEM-8 if it is used to predict concentrations of pollutants that are subject to decay in the atmosphere or that will react with other atmospheric constituents.

It is assumed that all pollutants are reflected when the plume impinges upon the ground. This does not account for pollutants that react with or are deposited on the ground or vegetation and other items located on the surface.

Suspended particulates are assumed to behave like a gas. Thus, it is assumed that there is no particulate fall-out along the plume path. This is a valid assumption for small particles, but if large particles are present, a predictive algorithm based upon the terminal velocities of the large particles would probably yield more accurate results.

2.5.6. Area Source Algorithm

The area source algorithm used in the TEM-8 assumes that emissions are made at ground level. The derived equation becomes unmanageable if a source height is included. Most area sources emit pollutants within 10 meters of the surface, so this assumption will not drastically alter most concentration predictions. Note that the area source emission rate is not dependent upon the area of the source, and that it is assumed that the emissions occur at the center of the source. Furthermore, in the TEM-8 the impact of an area source is limited to the nearest four receptors downwind of the source.

List of Symbols

A	Area of area source.
A_j	Area of area source in the jth calculation grid square.
$a(S)$	Coefficient for power law curve approximation of σ_z. Is a function of S. See equation (2).
$b(S)$	Exponent for power law curve approximation of σ_z. Is a function of S. See equation (2).
C	Stack-tip downwash correction factor.
$c(S)$	Coefficient for power law curve approximation of σ_y. Is a function of S. See equation (3).
D	Stack diameter.
$d(S)$	Exponent for power law curve approximation of σ_y. Is a function of S. See equation (3).
F	Buoyancy flux for a plume.
g	Acceleration due to gravity.
H	Effective stack height.
h	Physical stack height.
Δh	Plume rise.
Δh_{max}	Final plume rise.
K_y	Crosswind factor used to determine downwind concentration. See equation (16).
K_z	Vertical factor used to determine downwind concentration. See equation (16).
L	Mixing height.
$P(S)$	Exponent used in equation (5) for adjustment of wind speed to a given height. Is a function of S.

Q	Source emission rate.
Q_j	Area source emission rate for jth calculation square covered by an area source.
$q(S)$	Exponent used in equation (31) for adjustment of σ_y to a given time averaging period. Is a function of S.
R	Stack radius.
$R(S)$	Exponent used in equation (4) for adjustment of σ_y to a given time averaging period. Is a function of S.
S	Atmospheric stability class.
T	Temperature at point source exit.
T_A	Ambient temperature.
t	Time averaging period.
$t_{1/2}$	Half-life.
U	Average wind speed at stack height.
U_o	Average surface wind speed (as measured at 10 meters above the ground).
U_z	Wind speed at height z.
V	Stack exit velocity.
x	Downwind distance from the stack.
x_{max}	Point of maximum concentration.
Δx	Size of receptor (calculation) grid square.
y	Crosswind distance from the plume centerline.
z	Vertical distance from ground level.
Δ	Crosswind angle (angle between wind direction azimuth and the azimuth from the source to the receptor).
δ	An increment of Δ shown above.
ξ	Angle between wind azimuth and the nearest calculation grid coordinate.
σ_y	Standard deviation of the concentration distribution in the crosswind direction.

σ_{y_t}	σ_y value for time averaging period t.
σ_z	Standard deviation of the concentration distribution in the vertical direction.
χ	Pollutant concentration.

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3. USERS' GUIDE

3.1 SUMMARY OF PROGRAM INPUTS

Input to the TEM-8 can be divided into four sections as listed below:

3.1.1 Control Parameters (5 cards)

Control parameters remain constant throughout the run regardless of changes in meteorological parameters in different scenarios. They specify time averaging period, grid coordinates and spacing of the receptor grid, the type of output desired, the calibration factors to be applied to the output, and the pollutant and calibration factor labels.

3.1.2. Scenario Parameters (1-24 cards)

From one to twenty-four scenarios may be created in each run. Each scenario in a run uses the same inventory of area and point sources and receptor grid, but different meteorological conditions. Meteorological information (wind direction, mixing height, etc.) for each scenario is contained on one card.

3.1.3 Area Sources (0-50 cards)

Each area source card contains the location, size, and emission rates of an area source.

3.1.4 Blank Card

This blank card signals the end of the area source card deck.

3.1.5 Point Sources (0-300 cards)

Each point source card contains the location, stack parameters, and emission rates of a point source.

3.1.6 Blank Card

This card signals the end of the point source card deck.

Each parameter in each of the four input sections will now be described in detail. Several TEM-8 data coding forms used by the Texas Air Control Board will illustrate the format of the input data. A typical input deck of cards is illustrated in Figure 3.1.

3.2 CONTROL PARAMETERS

Figure 3-2 illustrates a TEM-8 coding form used by the Texas Air Control Board for the control parameter cards. The following five control parameter cards must always be included in each TEM-8 run.

3.2.1 Card 1: TT(1) to TT(20)

TT (Format 20A4): Title. All 80 columns of Card 1 may be used to identify the run. The title is printed on every page of the output and is punched on the first card if punched card output is requested.

3.2.2 Card 2: NTOPT, NWDOPT, NWSOPT, NSCEN, NPOL, NLIST, NARRAY, NPUNCH, NCSOPT, NMAX, NSTDWN, INTPUN, NSRCOP, NPRINT, INPTSC

A. NTOPT (integer, column 3): Averaging time option. The σ_y values in the TEM-8 were derived for a plume averaging time of ten minutes. For longer averaging periods, the horizontal meander of the plume, caused by fluctuations in the wind direction, results in a larger σ_y. Values for σ_y are adjusted by use of equation (4) given in Section 2.2.1.4. The available averaging times are shown in Table 3-1. The default value is NTOPT=1.

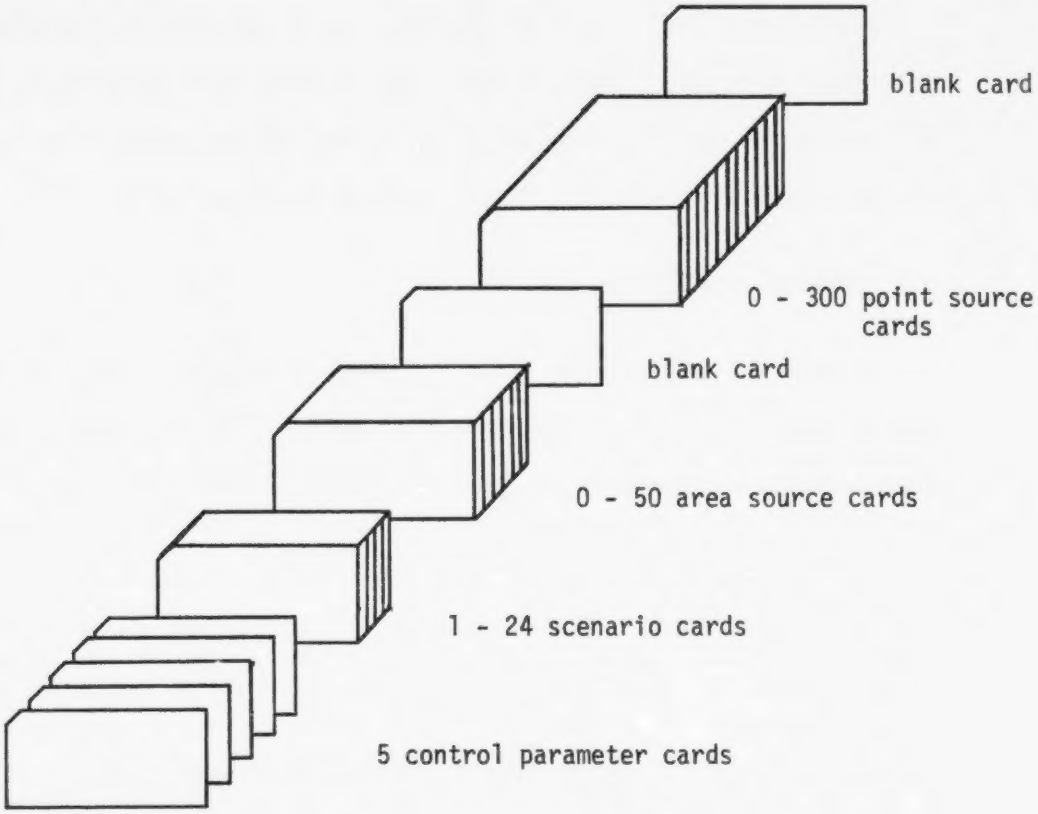
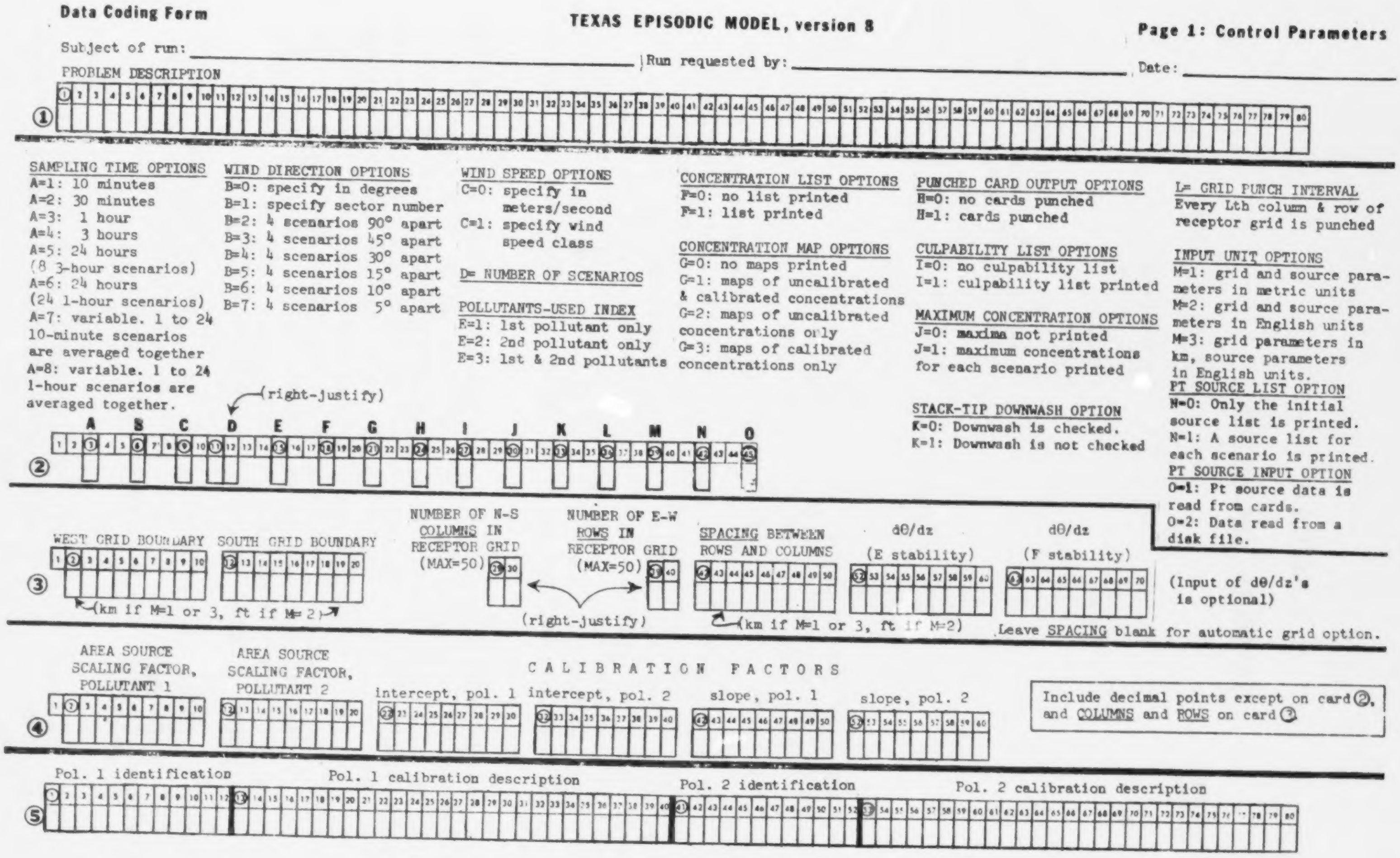

blank card
0 - 300 point source cards
blank card
0 - 50 area source cards
1 - 24 scenario cards
5 control parameter cards

Figure 3-1. TEM-8 Input Deck Structure



Data Coding Form

TEXAS EPISODIC MODEL, version 8

Page 1: Control Parameters

Subject of run: ______ Run requested by: ______ Date: ______

①

PROBLEM DESCRIPTION

SAMPLING TIME OPTIONS
A=1: 10 minutes
A=2: 30 minutes
A=3: 1 hour
A=4: 3 hours
A=5: 24 hours
(8 3-hour scenarios)
A=6: 24 hours
(24 1-hour scenarios)
A=7: variable. 1 to 24 10-minute scenarios are averaged together
A=8: variable. 1 to 24 1-hour scenarios are averaged together.

WIND DIRECTION OPTIONS
B=0: specify in degrees
B=1: specify sector number
B=2: 4 scenarios 90° apart
B=3: 4 scenarios 45° apart
B=4: 4 scenarios 30° apart
B=5: 4 scenarios 15° apart
B=6: 4 scenarios 10° apart
B=7: 4 scenarios 5° apart

WIND SPEED OPTIONS
C=0: specify in meters/second
C=1: specify wind speed class

D= NUMBER OF SCENARIOS

POLLUTANTS-USED INDEX
E=1: 1st pollutant only
E=2: 2nd pollutant only
E=3: 1st & 2nd pollutants

CONCENTRATION LIST OPTIONS
F=0: no list printed
F=1: list printed

CONCENTRATION MAP OPTIONS
G=0: no maps printed
G=1: maps of uncalibrated & calibrated concentrations
G=2: maps of uncalibrated concentrations only
G=3: maps of calibrated concentrations only

PUNCHED CARD OUTPUT OPTIONS
H=0: no cards punched
H=1: cards punched

CULPABILITY LIST OPTIONS
I=0: no culpability list
I=1: culpability list printed

MAXIMUM CONCENTRATION OPTIONS
J=0: maxima not printed
J=1: maximum concentrations for each scenario printed

STACK-TIP DOWNWASH OPTION
K=0: Downwash is checked.
K=1: Downwash is not checked

L= GRID PUNCH INTERVAL
Every Lth column & row of receptor grid is punched

INPUT UNIT OPTIONS
M=1: grid and source parameters in metric units
M=2: grid and source parameters in English units
M=3: grid parameters in km, source parameters in English units.

PT SOURCE LIST OPTION
N=0: Only the initial source list is printed.
N=1: A source list for each scenario is printed.

PT SOURCE INPUT OPTION
O=1: Pt source data is read from cards.
O=2: Data read from a disk file.

(right-justify)

② A B C D E F G H I J K L M N O

③

WEST GRID BOUNDARY

SOUTH GRID BOUNDARY

(km if M=1 or 3, ft if M=2)

NUMBER OF N-S COLUMNS IN RECEPTOR GRID (MAX=50)

NUMBER OF E-W ROWS IN RECEPTOR GRID (MAX=50)

(right-justify)

SPACING BETWEEN ROWS AND COLUMNS

(km if M=1 or 3, ft if M=2)

dθ/dz (E stability)

dθ/dz (F stability)

(Input of dθ/dz's is optional)

Leave SPACING blank for automatic grid option.

④

AREA SOURCE SCALING FACTOR, POLLUTANT 1

AREA SOURCE SCALING FACTOR, POLLUTANT 2

CALIBRATION FACTORS

intercept, pol. 1

intercept, pol. 2

slope, pol. 1

slope, pol. 2

Include decimal points except on card ②, and COLUMNS and ROWS on card ③

⑤

Pol. 1 identification

Pol. 1 calibration description

Pol. 2 identification

Pol. 2 calibration description

Figure 3-2 Control Parameters Coding Form

TABLE 3-1

Averaging Time Options

NTOPT	Averaging Times
1	10 minutes
2	30 minutes
3	1 hour
4	3 hours
5	24 hours (8 3-hour scenarios)
6	24 hours (24 1-hour scenarios)
7	Variable: 10 min, 20 min, 30 min, 40 min, ..., 240 min
8	Variable: 1 hr, 2 hrs, 3 hrs, 4 hrs, ..., 24 hrs

NTOPT=5 and NTOPT=6 are special cases where a 24-hour concentration is determined by averaging concentrations calculated with multiple scenarios. These averaging time options require a specific number of scenario cards. NTOPT=5 requires exactly eight scenario cards where each card contains a three-hour period of meteorological data. The eight three-hour average concentrations are summed and then divided by eight to obtain the 24-hour average concentration. For example, using this option, it is not permitted to input 16 scenario cards and receive two 24-hour averages. NTOPT=6 requires exactly 24 scenario cards in which each card contains a one-hour period of meteorological data. The 24 one-hour average concentrations are summed and then divided by 24 to yield a 24-hour average concentration.

NTOPT=7 and NTOPT=8 are special cases providing a variable averaging time defined by the user. By using NTOPT=7, up to 24 scenarios may be used to calculate ten-minute average concentrations which are averaged to provide an averaging time from 10 minutes to 240 minutes in 10-minute intervals. NTOPT=8 works in a similar way, but instead, permits a variable number of one-hour average concentrations to be averaged. As a result, a sample time of one hour, two hours, three hours, ... , or 24 hours may be obtained. When using NTOPT=7 or 8, the number of averaging periods is automatically keyed by the number of scenario cards that are included in the run.

It should be noted that NTOPT=5, 6, 7, or 8 may not be used with NWDOPT=2, 3, 4, 5, 6, or 7. This will be explained fully in the following section on the wind direction option.

B. NWDOPT (integer, column 6): Wind direction option. This option specifies the form in which wind direction is input for each scenario. The default value is NWDOPT=0.

NWDOPT=0 The wind direction will be input in degrees, from 0.0 to 360.0 for each scenario. By convention, wind direction is defined as the direction from which the wind is blowing.

NWDOPT=1 A wind sector number is specified for each scenario. Table 3-2 lists the sixteen possible sectors from which the wind may blow.

NWDOPT=2 This option requires the wind direction to be input in degrees and provides three additional sub-scenarios in which the wind is automatically shifted an additional 90° clockwise for each successive sub-scenario. For example, if a user requests this option and inputs a wind from 0.0° on the scenario card, then he will automatically receive four separate sub-scenarios with winds blowing from 0.0°, 90.0°, 180.0°, and 270.0°.

NWDOPT=3 This option requires a wind direction in degrees and automatically provides three sub-scenarios in which the wind is shifted an additional 45° clockwise for each successive sub-scenario.

NWDOPT=4 This option is similar to NWDOPT=2 or 3 but in this case the wind is shifted an additional 30° clockwise for each successive sub-scenario.

NWDOPT=5 In this option, the wind direction is input in degrees and automatically shifted an additional 15° clockwise for each successive sub-scenario.

NWDOPT=6 The wind direction is shifted an additional 10° clockwise for each successive sub-scenario.

NWDOPT=7 The wind direction is shifted an additional 5° clockwise for each successive sub-scenario.

Wind direction options 2 through 7 are useful for testing a complex array of sources for worst-case conditions. However, wind direction options 2 through 7 are not permitted to be used with NTOPT (time option)= 5, 6, 7, or 8 since the sub-scenarios will confuse the algorithm used to average the multiple scenarios.

C. NWSOPT (integer, column 9): Wind speed option. This option specifies the form in which wind speed is input for each scenario. The default value is NWSOPT=0.

NWSOPT=0 Surface wind speed (measured at 10 meters) is entered in meters/second for each scenario.

TABLE 3-2

Wind Sectors (NWDOPT=1)

Sector Number	Compass Point	Wind Direction, Degrees
1	N	0.0
2	NNE	22.5
3	NE	45.0
4	ENE	67.5
5	E	90.0
6	ESE	112.5
7	SE	135.0
8	SSE	157.5
9	S	180.0
10	SSW	202.5
11	SW	225.0
12	WSW	247.5
13	W	270.0
14	WNW	292.5
15	NW	315.0
16	NNW	337.5

NWSOPT=1 The surface wind speed class is input for each scenario. The six wind speed classes are discussed in Section 2.2.1.5 and listed in Table 3-3.

TABLE 3-3

TEM-8 Wind Speed Classes [2]

Wind Speed Class (National Weather Service)	Speed Interval (knots)	Central Wind Speed (meters/second)
1	0-3	1.50
2	4-6	2.46
3	7-10	4.47
4	11-16	6.93
5	17-21	9.61
6	>21	12.52

The options NWDOPT=0 and NWSOPT=0 are included primarily for use in model validation work, where measurements of wind speed and wind direction taken in the field don't quite fit the values for wind sectors and wind speed classes. For most applications, the other options for NWDOPT and NWSOPT tend to be more convenient.

D. NSCEN (integer, right justify in columns 11 and 12): Number of scenarios. The value of NSCEN determines how many scenario cards the TEM-8 will attempt to read. NSCEN may range from one to twenty-four. If NTOPT=5, NSCEN will automatically be set to eight. If NTOPT=6, the NSCEN is automatically set to 24. The model will not work correctly if the required number of scenario cards is not input when using these averaging time options. The default value is NSCEN=1.

E. NPOL (integer, column 15): Pollutants-used index. The user may choose to model two pollutants during a single run; or only the first pollutant; or only the second pollutant. However, when using the English unit input option, (NSRCOP=2), the user may input only one pollutant at a time. Therefore, if NSRCOP=2, then NPOL=1. The default value is NPOL=1.

NPOL=1 First pollutant only is used.

NPOL=2 Second pollutant only is used.

NPOL=3 First and second pollutants are used.

F. NLIST (integer, column 18): Concentration list output option. This output option provides the user with a list of the calculated concentrations at each receptor in the grid, one column of the grid per page. If this option is requested, then the program checks to ensure that no more than 600 pages of output will be produced. If more than 600 pages is expected to be generated, the program automatically cancels the requested concentration list option and prints a diagnostic message. The default value is NLIST=0.

NLIST=0 No list is printed.

NLIST=1 Concentration list is printed.

G. NARRAY (integer, column 21): Concentration array output option. This option provides a printout of the concentrations across the receptor grid in the form of a spatial array, requiring one, two, or four pages to display the entire grid. Each page can display concentrations for up to 25 grid columns and 25 grid rows. The default value is NARRAY=0.

NARRAY=0 No array maps are printed.

NARRAY=1 Maps of both uncalibrated and calibrated concentrations are printed.

NARRAY=2 Maps of uncalibrated concentrations only are printed.

NARRAY=3 Maps of calibrated concentrations only are printed.

H. NPUNCH (integer, column 24): Punched card output option. Concentration and receptor coordinates are punched onto cards, one receptor per card, for input to a contour plotting routine. The default value is NPUNCH=0.

NPUNCH=0 No cards are punched.

NPUNCH=1 The card punch option is turned on. Up to 10,000 cards may be punched.

I. NCSOPT (integer, column 27): Control strategy option. When this option is used the program prints a culpability list of the five point sources which contribute the most to the total concentration for each receptor. The top five contributors to each receptor are identified by a point source sequence number. In addition, the percent of the total concentration contributed by each of the five point sources is printed. The total concentration at the receptor is also printed for reference.

The control strategy option is in addition to any other printed output requested; it does not replace any other output option.

Due to limitations on computer core storage space, this option may be used for one pollutant only and with a receptor grid of no more than 25 columns and 25 rows.

When the control strategy option is employed with a 24 hour scenario run or with NTOPT=7 or 8, a culpability list is produced for each segment of the multiple scenario run, but not for the 24 hour total. The default value is NCSOPT=0.

NCSOPT=0 No culpability list is produced.

NCSOPT=1 The control strategy option is on, and a culpability list is produced for the first or second pollutant depending on NPOL. Note that NPOL may not be 3 if NCSOPT is 1.

J. NMAX (integer, column 30): Maximum concentration list option. This output option produces a list of the one receptor in the receptor grid which receives the highest concentration for each scenario. The receptor and the concentrations are printed. The default value is NMAX=0.

NMAX=0 Maximum concentration is not printed.

NMAX=1 Maximum concentration option is used.

K. NSTDWN (integer, column 33): Stack-tip downwash option. The TEM-8 normally determines stack-tip downwash effects. If the user chooses, he/she may have the program ignore these effects by disregarding this algorithm. It is then not used for any scenario of that run. The default value is NSTDWN=0.

NSTDWN=0 The stack-tip downwash algorithm is utilized.

NSTDWN=1 The stack-tip downwash algorithm is not used.

L. INTPUN (integer, column 36): Punch interval option. If punched card output is requested, INTPUN provides a way to limit the number of receptors from the grid that are to be punched. This feature is designed so that if the value for INTPUN is n, then every nth receptor in each row and column is punched onto a card. Thus, if INTPUN=2, one fourth of the receptors will be punched; if INTPUN=5, one twenty-fifth, etc. This option is included to permit contour plots to be generated without punching an unmanageable number of cards. Note that for a 50 x 50 grid with INTPUN=1, 2500 cards will be punched for each scenario. The default value is INTPUN=1.

INTPUN=1	Every receptor in each row and column is punched onto a card (if NPUNCH=1).
INTPUN=2	Every second receptor in each row and column is punched onto a card.
INTPUN=n	Every nth receptor in each row and column is punched onto a card.

M. NSRCOP (integer, column 39): Point source and grid input option. This input option allows point source and grid parameters to be input in English units, metric units, or a mixture of the two. Area sources must be input in metric units. The default value is NSRCOP=1.

NSRCOP=1	The grid and point source parameters are input in metric units.
NSRCOP=2	The grid and point source parameters are input in English units. It should be noted that only one pollutant may be modeled using this format.
NSRCOP=3	Grid coordinates are input in metric units while point source parameters are input in English units.

N. NPRINT (integer, column 42): Point source list printout option. This option allows the user to reduce the number of pages printed when making multiple scenario runs. The TEM-8 generates a list of all of the point sources and their parameters at the start of each program. In addition, a list of the point source parameters and effective stack heights may be printed for each scenario. Each page lists up to 50 point sources. The default value is NPRINT=0.

NPRINT=0	Only the initial point source list is printed.
NPRINT=1	The initial point source list is printed along with a list of point sources and their calculated effective stack height for each scenario.

O. INPTSC (integer, column 45): Point source data read option. This option allows the user to input the point source data from a card deck or from a disk file. The default value is INPTSC=1.

INPTSC=1	Point source data is read into the TEM-8 program from cards.
INPTSC=2	Point source data is input from a disk file specified by the user in his/her own control card set.

3.2.3 Card 3: XRSWC, YRSWC, LX, LY, GRID, DTDZ(1), DTDZ(2)

XRSWC (real, columns 2-10): The X, or east-west coordinate of the receptor at the southwest grid corner. Units are kilometers if NSRCOP=1 or 3; feet if NSRCOP=2. The default value is XRSWC=0.0.

YRSWC (real, columns 12-20): The Y, or north-south, coordinate of the receptor at the southwest grid corner. Units are kilometers if NSRCOP=1 or 3, feet if NSRCOP=2. The default value is YRSWC=0.0.

LX (integer, columns 29-30, right-justified): The number of columns (number of receptors) per row in the receptor grid. The maximum value for LX is 50. The default value is LX=1.

LY (integer, columns 39-40, right-justified): The number of rows (number of receptors) per column in the receptor grid. The maximum value for LY is 50. The default value is LY=1.

GRID (real, columns 42-50): The spacing between rows and columns of receptors. Units are kilometers if NSRCOP=1 or 3; feet if NSRCOP=2. The default value is GRID=0.0, which initiates the automatic grid subroutine of the TEM-8. This subroutine chooses the size and placement of the receptor grid to ensure that the point of maximum concentration will fall within the grid. (See Section 2.3.2 for a complete discussion of the automatic grid option.)

A sample receptor grid is shown in Figure 2-4. An important point to note is that the receptors are located at the intersections of the receptor grid. Therefore, the coordinates of the receptor at the southwestern grid corner are input to the model. Point sources may be located anywhere inside or outside of the grid. Area sources should be designed to fit into an integral number of "calculation" grid squares which are the same size as the receptor grid squares, but with the receptor located in the center of the square. The coordinates of the southwestern corner of each area source will be input on a different card.

DTDZ (1) (real, columns 52-60): The potential temperature gradient, $d\theta/dz$, for Class E atmospheric stability. The units for DTDZ are °C/meter. The potential temperature gradient is used in the stable/buoyant and stable/momentum plume rise equations. This quantity may be input to the program or allowed to default to a stored value. For general application, the stored default value of DTDZ(1) is 0.02 °C/meter. For sources located in Texas, a more appropriate value has been found to be DTDZ(1)=0.018 °C/meter.

DTDZ(2) (real, columns 62-70): The potential temperature gradient for Class F atmospheric stability. For general use, the stored value of DTDZ(2) is 0.035 °C/meter. For most Texas modeling runs an appropriate value is DTDZ(2)=0.025 °C/meter.

3.2.4 Card 4: ASCALE(1), ASCALE(2), A(1), A(2), B(1), B(2).

ASCALE(1), ASCALE(2) (real, columns 2-10 and 12-20 respectively): Area source scaling factors for each pollutant. The emission rate of every area source is multiplied by ASCALE(1) for pollutant 1 and ASCALE(2) for pollutant 2. This feature is very useful in control strategy and predictions, when the entire area source inventory may be scaled to reflect higher traffic volume in future years, etc. without having to generate an entire new set of area sources. The default values are ASCALE=0.0.

A(1), A(2) (real, columns 22-30 and 32-40, respectively): These are the zeroth-degree calibration coefficients for each pollutant. B(1), B(2) (real, columns 42-50 and 52-60 respectively): These are the first-degree calibration coefficients for each pollutant.

A and B are used to calculate calibrated concentrations of each pollutant according to the formula

$$\chi_{cal} = A + B\chi$$

where χ_{cal} and χ are calibrated and uncalibrated concentrations respectively. The default values are A=B=0.0. Both calibrated and uncalibrated concentrations appear in all output options except the culpability list option. The calibration feature has many uses. It permits conversion of concentrations from micrograms per cubic meter to percent allowable or parts per million, etc. In addition, it can be used to apply a correction factor derived from a model validation study.

3.2.5 Card 5: POLNAM(1), CALNAM(1), POLNAM(2), CALNAN(2).

POLNAM(1), POLNAM(2) (alphanumeric, columns 1-12 and 41-52, respectively): These two variables contain the labels for identifying the first and second pollutant concentrations in all of the output options. Anything may be entered into these variables since they serve only as labels. The default values of POLNAM(1) and (2) are blank characters.

CALNAM(1), CALNAM(2) (alphanumeric, columns 13-40 and 53-80, respectively): These two variables are used to describe the calibration factors that were input on Card 4. The user may input anything to these variables since they are used as labels. The default values of CALNAM(1) and (2) are blank characters.

3.3 SCENARIO PARAMETER CARDS (See Figure 3-3)

Each card (up to 24): NSC(i), NWS(i), NWD(i), WS(i), WD(i), TA(i), HALF(i,1), HALF(i,2), PEN(i), HMIX(i); i is the scenario number.

NSC (integer, column 3): Stability class number. The atmospheric stability is specified for each scenario by an NSC value between 1 and 7. Table 3-4 lists the atmospheric stability classes used in the TEM-8. There is no default value for NSC.

TABLE 3-4

Atmospheric Stability Classes

NSC	Pasquill-Gifford Atmospheric Stability Class	Description
1	A	Very unstable
2	B	Moderately unstable
3	C	Slightly unstable
4	D-day	Neutral day
5	D-night	Neutral night
6	E	Slightly stable
7	F	Stable (rural only)

The relationship between the atmospheric stability classes and wind speed, incoming solar radiation and cloud cover is shown in Table 3-5. Class A is the most unstable, while Class F is the most stable class considered in the TEM-8. Night refers to the period from 1 hour before sunset to 1 hour after sunrise. Note that the neutral class, D, should be assumed for overcast conditions during day or night, regardless of wind speed.

TABLE 3-5

Key to Atmospheric Stability Classes

	Day			Night	
Surface Wind Speed (at 10 meters), m/s	Incoming Solar Radiation Strong	Moderate	Slight	Thinly overcast or ≥4/8 low clouds	≤3/8 cloud
<2	A	A-B	B	*	*
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
>6	C	D	D	D	D

Table 3-5 was given by Turner [3].

*With very light winds on a clear night for ground-level sources free of topographic influences, frequent shifts in wind direction usually

Left-justify and include decimal
point unless stated otherwise.

TEXAS EPISODIC MODEL

Texas Air Control Board

DATA CODING FORM

PAGE 2: Scenario Parameters

Subject of run: ______________________ Run requested by: ______________ Date: ____________

SCENARIO CARDS (one for each scenario; maximum of 24)

STABILITY CLASS
1: A very unstable.
2: B moderately unstable.
3: C slightly unstable.
4: DD neutral (day).
5: DN neutral (night).
6: E slightly stable.
7: F stable (rural only).

WIND SPEED CLASS

1:	1.50 m/s,	0- 3 knots.
2:	2.46	4- 6
3:	4.47	7-10
4:	6.93	11-16
5:	9.61	17-21
6:	12.52	over 21

WIND SECTOR

1:	N,	0°	9:	S,	180°
2:	NNE,	22.5	10:	SSW,	202.5
3:	NE,	45.	11:	SW,	225.
4:	ENE,	67.5	12:	WSW,	247.5
5:	E,	90.	13:	W,	270.
6:	ESE,	112.5	14:	WNW,	292.5
7:	SE,	135.	15:	NW,	315.
8:	SSE,	157.5	16:	NNW,	337.5

*** If C=0 on card 2, enter wind speed (m/s), not wind speed class.
If C=1, enter wind speed class, not wind speed.

*** If B=0 on card 2, enter wind direction, not sector.
If B=1, enter wind sector, not direction.

STAB-ILITY CLASS	WIND SPEED CLASS	WIND SECTOR	WIND SPEED (m/s)	WIND DIRECTION (degrees)	AMBIENT TEMPERATURE (degrees Celsius)	HALF-LIFE OF POLLUTANT 1 (hr)	HALF-LIFE OF POLLUTANT 2 (hr)	INVERSION PENETRATION FACTOR	MIXING HEIGHT (m)
3	6	9 10	14 15 16 17 18 19 20	24 25 26 27 28 29 30	34 35 36 37 38 39 40	44 45 46 47 48 49 50	54 55 56 57 58 59 60	64 65 66 67 68 69 70	74 75 76 77 78 79 80
3	6	9 10	14 15 16 17 18 19 20	24 25 26 27 28 29 30	34 35 36 37 38 39 40	44 45 46 47 48 49 50	54 55 56 57 58 59 60	64 65 66 67 68 69 70	74 75 76 77 78 79 80

(right-justify)

Figure 3-3. Scenario Parameter Coding Form

occur which serve to spread the plume horizontally. For elevated sources under these extremely stable situations, significant concentrations usually do not reach ground level until the atmospheric stability changes.

NWS (integer, column 6): Wind speed class. If the control parameter for wind speed, is zero, then this field is ignored and the surface wind speed for each scenario is given to the program in meters/second via WS(i). If NWSOPT=1, NWS should contain an integer from one to six, representing one of the six wind speed classes shown in Table 3-3. There is no default value for NWS. If NWSOPT=1, an NWS value must be given.

NWD (integer, columns 9-10, right-justified): Wind direction sector. If the control parameter for wind direction, NWDOPT, is zero, then this field is ignored, and the wind direction for each scenario is input in degrees via WD(i). If NWDOPT=1, NWD should contain an integer from one to sixteen, representing one of the sixteen compass points listed in Table 3-2. There is no default value for NWD. If NWDOPT=1, an NWD value must be given. If NWDOPT=2,3,4,5,6, or 7, then the NWD field is ignored.

WS (real, columns 14-20): Surface wind speed in meters per second measured at a height of 10 meters. If the control parameter NWSOPT=1, this field is ignored and the wind speed is entered by wind speed class number in field NWS. If NWSOPT=0, the variable WS should contain the desired surface wind speed in meters/second. There is no default value for WS. If NWSOPT=0, then a positive WS value must be given.

WD (real, columns 24-30): Wind direction in degrees. If the control parameter NWDOPT=1, this field is ignored, and the wind direction is input by wind sector number in field NWD. If NWDOPT=0, then WD should contain the azimuthal angle in degrees from which the wind is blowing. If NWDOPT=2,3,4,5,6, or 7, then the initial wind direction must be input to the field WD in degrees. The default value for WD is 0.0 degrees (a north wind).

TA (real, columns 34-40): Ambient temperature in degrees Celsius. The default value is 0.0 degrees Celsius.

HALF (i,1), HALF (i,2) (real, columns 44-50 and 54-60 respectively): Decay half-lifes in hours for the first and second pollutant. The default values are HALF=999.99 hours. This default value should produce no perceptible decay.

PEN (real, columns 64-70): Inversion penetrability factor. If the top of a stack is below the mixing height but the effective stack height is calculated to be greater than the mixing height, then a question remains concerning the plume's ability to penetrate the upper level inversion "boundary". A more complete discussion of the inversion penetrability factor may be found in Section 2.2.1.10. The value of PEN might range from 1.0 for a very weak inversion to 2.0 or more for a strong inversion. A specialist should be consulted for appropriate values to use for this variable. The default value is PEN=2.0.

HMIX (real, columns 74-80): Mixing height in meters. The default value is HMIX=9999.99 meters.

3.4 AREA SOURCES INVENTORY.

An example of an area and point source coding form used by the Texas Air Control Board is shown in Figure 3-4. From 0 to 50 area sources may be input to TEM-8 with one source per card. However, it is easy for the user to change the number of area sources in the TEM-8 inventory. Only the dimensions of the variables listed below need to be changed in each of the COMMON blocks (including those in each subroutine) in the program.

Area Source Variable
XA(50)
YA(50)
EA(50)
SIZE(50)

The blank card that follows the last area source card is used as a signal to the computer to indicate that all area source data has been input.

3.4.1 Each of 0-50 Cards: XA(i), YA(i), SIZE(i), EA(i,1), EA(i,2); where i is the sequence number of the source.

XA (real, columns 1-6): X-coordinate. XA is the X, or east-west coordinate of the southwest corner of the area source, in kilometers. The default value is XA=0.0 kilometers.

YA (real, columns 7-13): Y-coordinate. YA is the Y, or north-south coordinate of the southwest corner of the area source, in kilometers. The default value is YA=0.0 kilometers.

AREA SOURCE AND POINT SOURCE DATA CODING FORM FOR: TEXAS EPISODIC MODEL (TEM-8) - metric input option Texas Air Control Board

*** INCLUDE DECIMAL POINT FOR ALL PARAMETERS ***

SOURCE COORDINATES		(AREA SOURCES ONLY)	POLLUTANT EMISSION RATES		(I N P U T F O R P O I N T S O U R C E S O N L Y)						
X (km)	Y (km)	source size (m)	pollutant 1 (gm/s)	pollutant 2 (gm/s)	HEIGHT (m)	DIAMETER (m)	VELOCITY (m/s)	TEMPERATURE (degrees C)		IDENTIFICATION	
1 2 3 4 5 6	7 8 9 10 11 12 13	14 15 16 17 18 19 20	21 22 23 24 25 26 27 28	29 30 31 32 33 34 35 36	37 38 39 40 41 42 43	44 45 46 47 48	49 50 51 52 53 54 55	56 57 58 59 60 61 62	63 64 65 66 67 68	69 70 71 72 73 74 75 76	77 78 79 80

Figure 3-4. Area and Point Source Data Coding Form - Metric Input.

SIZE (real, columns 14-20): Dimensions of source. SIZE is the length of a side of the square area source in meters. There is no default value of SIZE. The user must input a value for SIZE for each area source that is used.

EA(i,1) and EA(i,2) (real, columns 21-28 and 29-36 respectively): Emission rates for the first and second pollutants. EA(i,1) and EA(i,2) represent emission rates in grams per second. Note that this is not an emission rate per unit area. Default values are EA=0.0 grams/second.

3.4.2. Construction of Area Source Inventories:

1. Superimpose a uniform grid on a map of the area of interest, with rows and columns of squares in the grid running east-west and north-south. The squares should be the same size as the smallest area source.

2. Fit each area source into the grid. Each area source must be square and should cover an integral number of grid squares. An example of several area sources fitted into a grid is shown in Figure 3-5. Note that it is possible to overlap area sources. One way this could be useful is in situations where a small, strong source is imbedded in a large, weak one.

3. Emissions are considered to come from the center of the area source. The emissions of the area source are equally divided among the grid squares covered by the source and then each grid square is treated as a separate area source. It is therefore possible for one area source card to generate 4, 25, 36, etc. area sources in the TEM-8. If more than one area source covers a grid square, then the emission rate of the square is the sum of the rates of the component area sources covering the square.

   Area sources located wholly or partially outside the computation grid are permitted.

   The area source format is the same, whether NSRCOP=1, 2, or 3. Units are kilometers, meters, and grams per second regardless of grid and point source units.

4. Once the area source grid has been determined, a receptor is placed at the center of each square. This grid is called the calculation grid. The receptor grid that is input to the TEM-8 is the same size as the calculation grid, but is shifted so that receptors are located at the

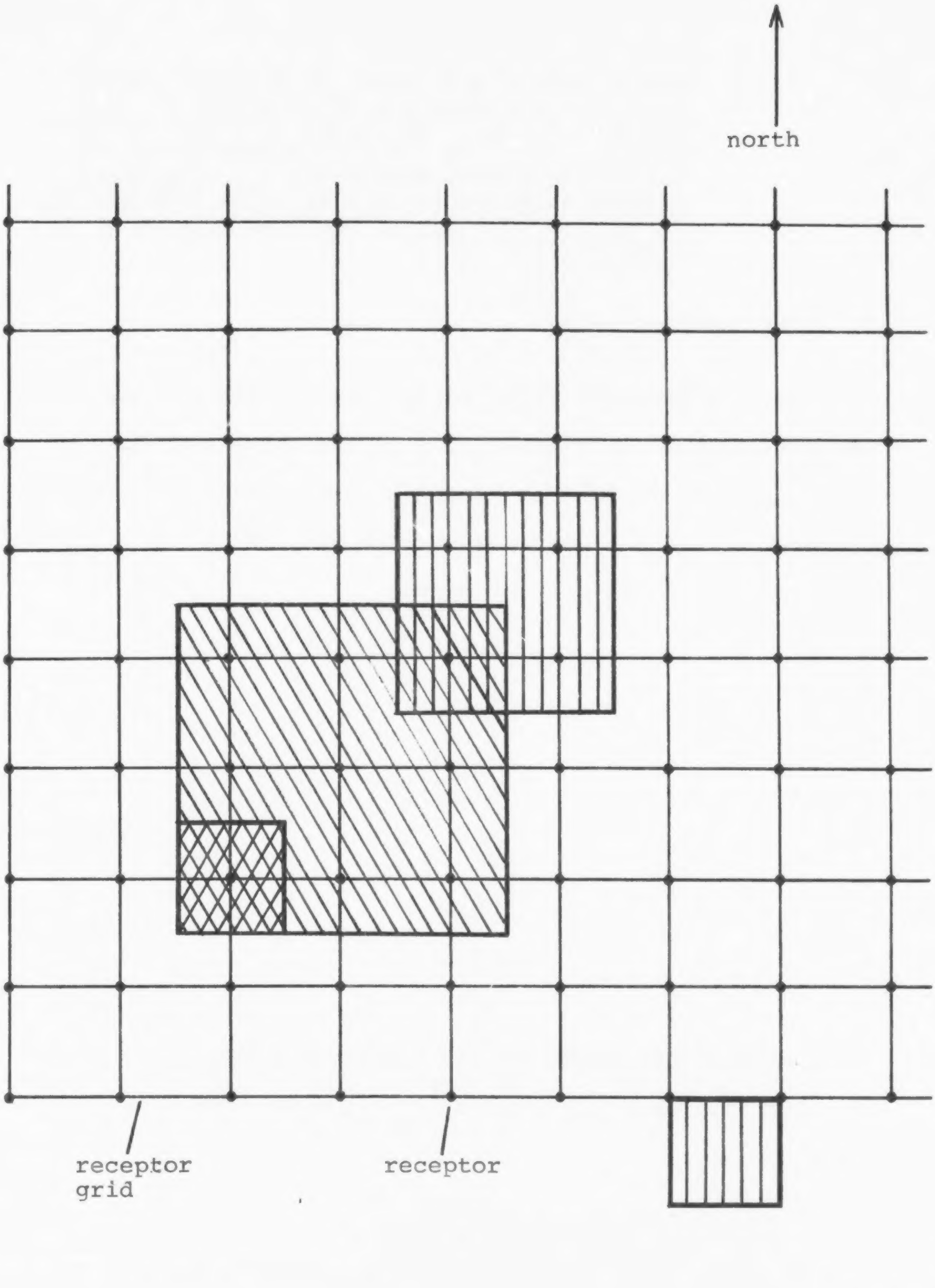

north
receptor grid
receptor

Figure 3-5. Example of Placement of Area Sources

intersections of grid lines. To obtain the receptor grid, shift the calculation grid one-half of a grid spacing to the north and one-half of a grid spacing to the east. See Figure 2-4 for a diagram showing the relationship between these grids. All coordinates including those used in the area source inventory that are input to TEM-8 must be determined relative to the receptor grid.

3.5 POINT SOURCE INVENTORY

From 0 to 300 point sources may be input to TEM-8 with one source per card. However, it is easy for the user to change the number of point sources in the TEM-8 inventory. Only the dimensions of the variables listed below need to be changed in each of the COMMON blocks (including those in each subroutine) of the program.

Point Source Variables

XP(300)

YP(300)

EP(300,2)

HP(300)

DP(300)

VP(300)

TP(300)

The blank card that follows the last point source card is used as a signal to the computer to indicate that all point source data has been input.

3.5.1 Point Sources for NSRCOP=1.

An example of an area and point source coding form used by the Texas Air Control Board is shown in Figure 3-4.

Each of 0-300 Cards: XP(i), YP(i), EP(i,1), EP(i,2), HP(i), DP(i), VP(i), TP(i), NAME(1), NAME(2); where i is the sequence number of source.

XP (real, columns 1-6): X-coordinate. XP is the X, or east-west coordinate of the point source, in kilometers. The default value is XP=0.0 kilometers.

YP (real, columns 7-13): Y-coordinate. YP is the Y, or north-south, coordinate of the point source in kilometers. The default value is 0.0 kilometers.

EP(i,1) (real, columns 21-28): Emission rates. EP(i,1) is the emission rate of pollutant-1 in grams per second. The default value is 0.0 grams per second.

EP(i,2) (real, columns 29-36): Emission rates. EP(i,2) is the emission rate of pollutant-2 in grams per second. The default value is 0.0 grams per second.

HP(real, columns 37-43): Source height. HP is the physical height of the stack in meters. The default value is HP=0.0 meters.

DP (real, columns 44-48): Source diameter. DP is the inside exit diameter of the source in meters. The default value is DP=0.0 meters; but this value will produce an error message and terminate the program.

VP (real, columns 49-55): Exit velocity. VP is the stack exit velocity in meters per second. The default value is VP=0.0 meters per second; but this value will yield zero plume rise.

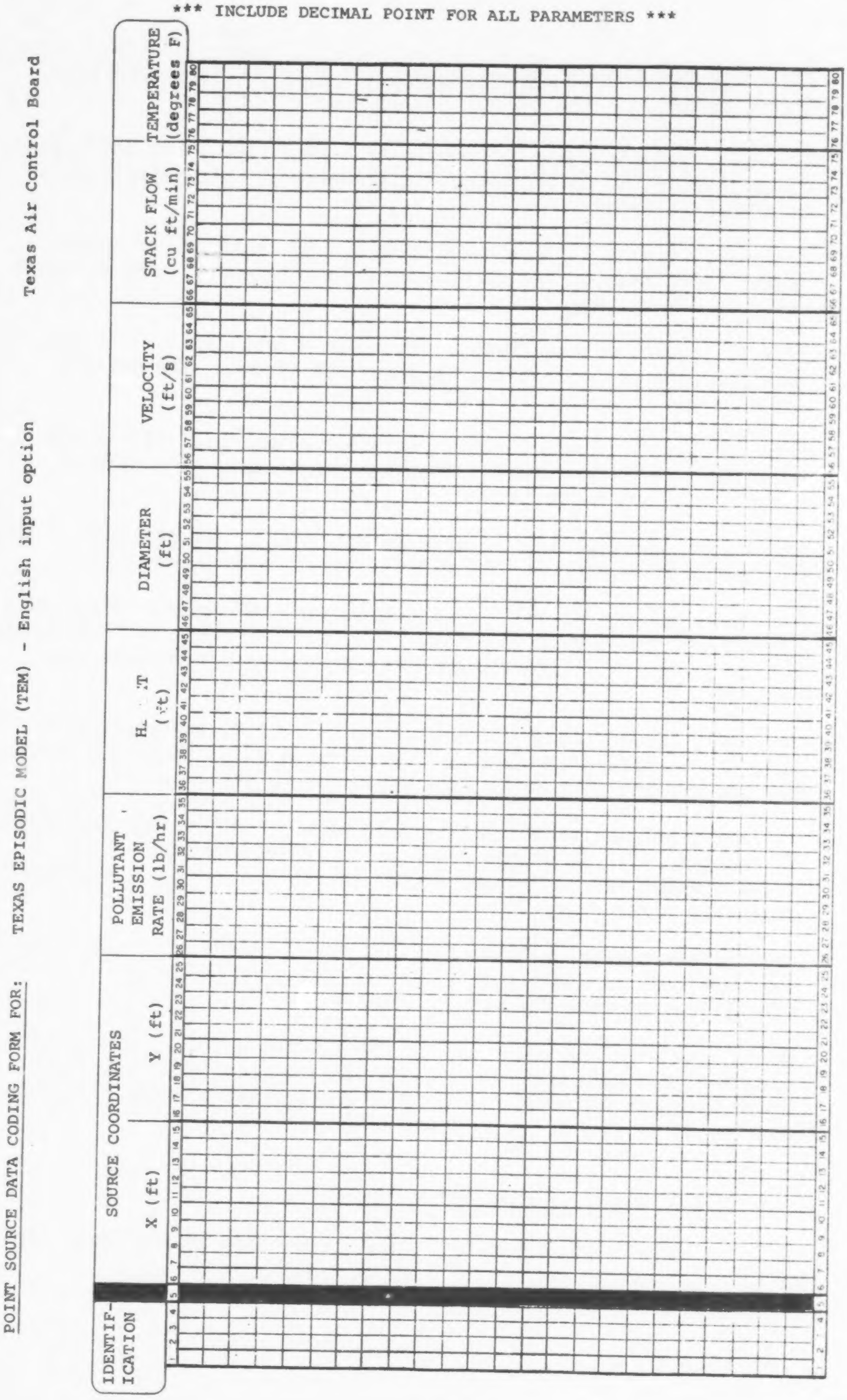
TP (real, columns 56-62): Exit temperature. TP is the temperature, in degrees Celsius, of the plume as it leaves the stack. The default value is 0.0 degrees which usually results in a momentum-dominated plume rise.

NAME (alphanumeric, columns 69-76): Source identification. NAME(i,1) and NAME(i,2) constitute an eight-character field containing an identification code for each source.

NOTE: The area and point source formats and units for NSRCOP=1 are identical to those used in the EPA's Climatological Dispersion Model [2] and the Texas Air Control Board Board's Texas Climatological Model [1].

3.5.2 Point Sources for NSRCOP=2.

An example of an NSRCOP=2 Coding Form used by the Texas Air Control Board as shown in Figure 3-6.



POINT SOURCE DATA CODING FORM FOR: TEXAS EPISODIC MODEL (TEM) - English input option

Texas Air Control Board

IDENTIFICATION		SOURCE COORDINATES		POLLUTANT EMISSION RATE (lb/hr)	HEIGHT (ft)	DIAMETER (ft)	VELOCITY (ft/s)	STACK FLOW (cu ft/min)	TEMPERATURE (degrees F)
		X (ft)	Y (ft)						
1 2 3 4	5	6 7 8 9 10 11 12 13 14 15	16 17 18 19 20 21 22 23 24 25	26 27 28 29 30 31 32 33 34 35	36 37 38 39 40 41 42 43 44 45	46 47 48 49 50 51 52 53 54 55	56 57 58 59 60 61 62 63 64 65	66 67 68 69 70 71 72 73 74 75	76 77 78 79 80

*** INCLUDE DECIMAL POINT FOR ALL PARAMETERS ***

Figure 3-6. Area and Point Source Data Coding Form - English Input

Each of 0-300 Cards: NAME(i,1), XP(i), YP(i), EP(i,1), HP(i), DP(i), VP(i), ACFM, TP(i); where i is the sequence number of sources.

NAME (alphanumeric, columns 1-4): Source identification. NAME(i,1) is a four-character field containing an identification code for each source.

XP (real, 6-15): X-coordinate. XP is the X, or east-west coordinate of the point source, in feet. The default value is 0.0 feet.

YP (real, 16-25): Y-coordinate. YP is the Y, or north-south coordinate of the point source in feet. The default value is YP=0.0 feet.

EP (real, 26-35): Emission rate. EP(i,1) is the emission rate of pollutant-1 in pounds per hour. Default value is EP(i,1)=0.0 pounds per hour. Note: in this format only one pollutant emission rate may be input for each point source.

HP (real, 36-45): Source height. HP is the physical height of the stack in feet. Default value is HP=0.0 feet.

DP (real, 46-55): Source diameter. DP is the inside exit diameter of the source, in feet. The default value is DP=0.0 feet, but this value will produce an error message and terminate the program.

VP (real, 56-65): Exit velocity. VP is the stack exit velocity in feet per second. If VP=0.0 feet per second, then VP is calculated from ACFM and DP (see below). If ACFM is also zero, then VP=0.0 feet per second which results in zero plume rise for the source.

ACFM (real, 66-75): Stack flow rate. ACFM is the stack flow rate of the source in cubic feet per minute. It is used only to calculate exit velocity if VP is not given. The formula is:

$$VP = \frac{ACFM}{(47.1239\ (DP)^2)} \qquad (27)$$

As noted above, if VP and ACFM are zero, the VP used by the program is zero.

TP (real, 76-80): Exit temperature. TP is the temperature in degrees Farenheit, of the plume as it leaves the stack. The default value is 0.0 degrees which usually resulting in a momentum-dominated plume rise.

3.5.3 Point Sources for NSRCOP=3.

An example of a point source coding form used by the Texas Air Control Board is shown in Figure 3-7.

Each of 0-300 Cards: XP(i), YP(i), EP(i,1), EP(i,2), HP(i), DP(i), VP(i), TP(i), ACFM(i), NAME(i); where i is the sequence number of source.

XP (real, 1-8): X-coordinate. XP is the X, or east-west coordinate of the point source in kilometers. The default value of 0.0 kilometers.

YP (real, 9-16): Y-coordinate. YP is the Y, or north-south coordinate of the point source in kilometers. The default value is YP=0.0 kilometers.

EP(i,1), EP(i,2) (real, 17-23, 24-30): Emission rate. EP(i,1) and EP(i,2) are the emission rates for the two pollutants in pounds per hour. The default value is 0.0 pounds per hour.

HP (real, 31-37): Source height. HP is the physical height of the stack in feet. The default value is HP=0.0 feet.

DP (real, 38-43): Source diameter. DP is the inside exit diameter of the source in feet. The default value is DP=0.0 feet, but this value will produce an error message and terminate the program.

VP (real, 44-50): Exit velocity. VP is the stack exit velocity in feet per second. If VP=0.0, then VP is calculated from ACFM and DP (see below). If ACFM is also zero, then VP=0.0 feet per second which results in zero plume rise for the source.

TP (real, 51-57): Exit temperature. TP is the temperature, in degrees Fahrenheit of the plume as it leaves the stack. The default value is 0.0 degrees which usually results in a momentum-dominated plume rise.

ACFM (real, 58-64): Stack flow rate. ACFM is the stack flow of the source in cubic feet per minute. It is used only to calculate exit velocity if VP is not given. The formula is:

$$VP = \frac{ACFM}{(47.1239\ (DP)^2)}$$

As noted above, if VP and ACFM are zero, then VP used by the program is zero.

NAME (alphanumeric, columns 65-80): Source identification. This variable constitutes a 16 character field containing an identification code for each source.

4. TEM-8 FLOW DIAGRAMS

The Texas Episodic Model Version 8 (TEM-8) is written in Fortran IV language. At the present time the Texas Air Control Board uses a Burroughs B6807 computer for the TEM-8.

TEM-8 contains a main program and 12 subroutines. Table 4-1 defines the variables used in the following flow diagrams.

The main program calculates pollutant concentrations at each affected receptor while the subroutines perform ancillary functions. Subroutine INMOD reads grid, meteorological, and source inventory data into the proper storage locations. Subroutine INDATA selects and stores the appropriate values for KY, DEL, and ANGLIM based on the selected averaging time. If the automatic grid is requested, subroutine AUTGRD determines the grid parameters to be used. Subroutine RISE is used to calculate effective stack heights for point sources. KYCAL calculates the values for KYC either explicitly or by interpolation from the KY table. Similarly, KZCAL calculates KZC values. If the culpability list is requested, WORST determines the five highest point source contributors at each receptor. WOROUT then prints the culpability list.

Subroutine OUTMOD coordinates the various output requests. ARRAY prints the array map of concentrations. If a listing of the maximum concentrations for each scenario is requested, SCENMX determines the list and MAXOUT prints the list.

The following flow diagrams briefly outline the basic programming steps used in the TEM-8. The complete program is listed in Appendix I.

TABLE 4-1

List of Variables Used in the Flowcharts

Variable	Function
ANGLIM	Largest value for DELTA for which calculations are made.
D80	Downwind distance at which vertical mixing is complete.
D47	Downwind distance at which the mixing height first affects vertical mixing.
DEL	The value of this variable is equal to one-seventh of ANGLIM.
DELTA	Angle between wind azimuth and the source-receptor azimuth.
DIST	Distance between the source and the receptor.
ESH(I)	ESH(1) is the distance-dependent effective source height. ESH(2) is the peak effective source height.
GX(I)	GX(1) is the largest value of XTM(1). GX(2) is the largest value of XTM(2).
GY(I)	Distance to source along the y-axis.
HMIX	Height of mixing layer.
HPEN	Maximum effective source height necessary for plume to penetrate the inversion.
IGRID	An internal parameter used to switch on the autogrid subroutine.
INDEX	An internal parameter used to cue different sections of subroutine INMOD.
IRISE	An internal parameter used to cue different sections of subroutine RISE.
ISC	The stability class number.

ISCEN	The Ith scenario.
IWDOPT	Wind direction sub-scenario counter.
IX	An internal loop counter for receptor columns.
JY	An internal loop counter for receptor rows.
KY	Pre-calculated tabular values for the Gaussian equation.
KYC	A value either interpolated from the KY tables or calculated explicitly.
KZ	Pre-calculated tabular values for the Gaussian equation.
KZC	A value either interpolated from the KZ tables or calculated explicitly.
LX	Number of columns in the receptor grid.
LXMAX	Length of grid in X (east-west) direction.
LY	Number of rows in the receptor grid.
LYMAX	Length of grid in Y (north-south) direction.
NAS	Number of area sources.
NCSOPT	Control strategy (culpability list) option parameter.
NLIST	List option parameter.
NMAX	Maximum concentration list option parameter.
NPRINT	A variable for the point source list printed option.
NPS	Number of point sources.
NSCEN	Number of scenarios.
NSRCOP	A parameter for the source and grid units input option.
NTOPT	The averaging time option parameter.
NWDOPT	The wind direction option parameter.
PEAK	Distance downwind of the source at which the plume reaches its maximum height.
U	Average wind speed at stack height.
V	The stack exit velocity.
XTM(I)	Distance in X direction to the point of maximum concentration.

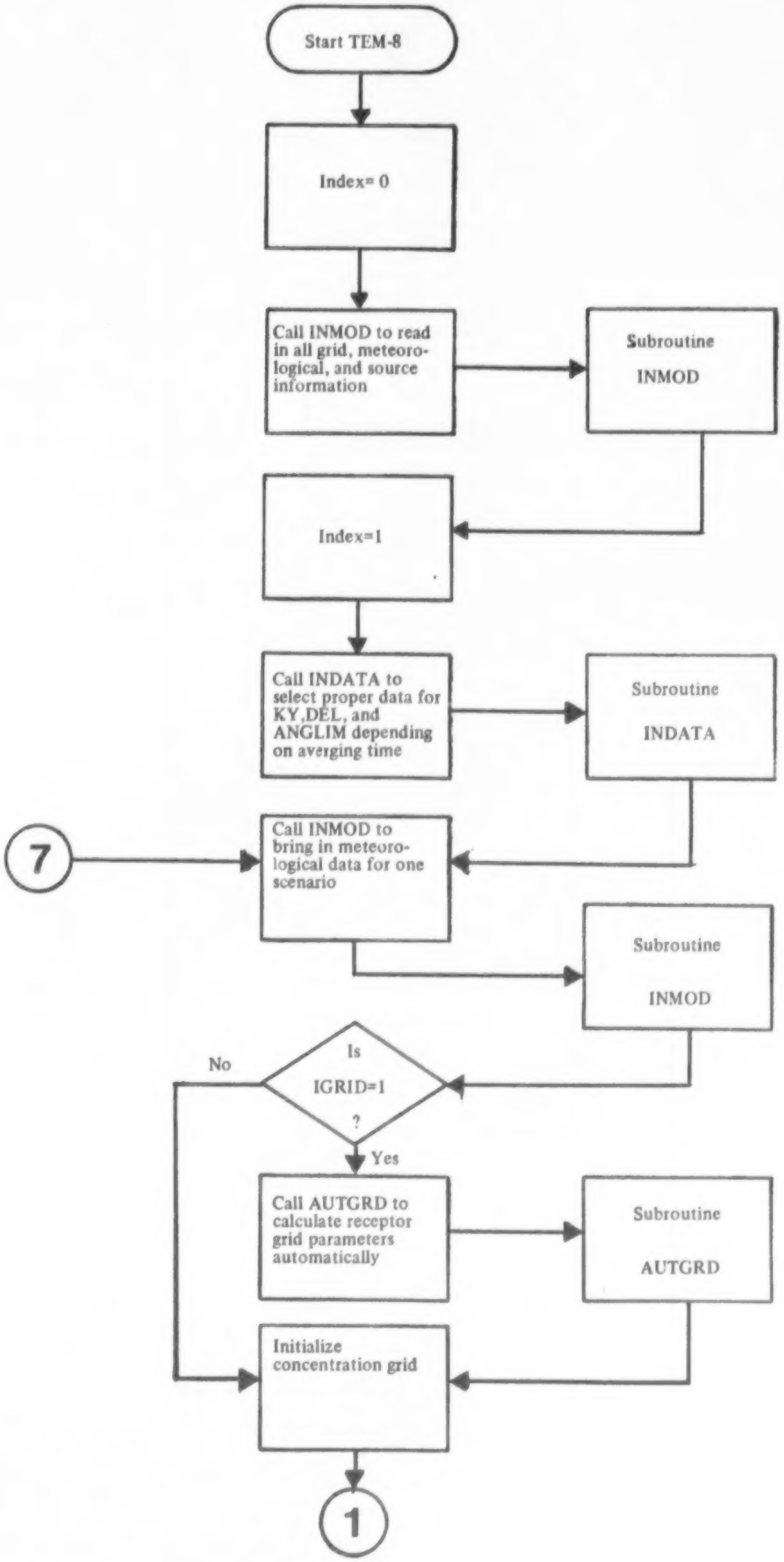

Start TEM-8
Index= 0
Call INMOD to read in all grid, meteorological, and source information
Subroutine INMOD
Index=1
Call INDATA to select proper data for KY,DEL, and ANGLIM depending on averging time
Subroutine INDATA
7
Call INMOD to bring in meteorological data for one scenario
Subroutine INMOD
Is IGRID=1 ?
No
Yes
Call AUTGRD to calculate receptor grid parameters automatically
Subroutine AUTGRD
Initialize concentration grid
1

Figure 4-1 TEM-8 Program

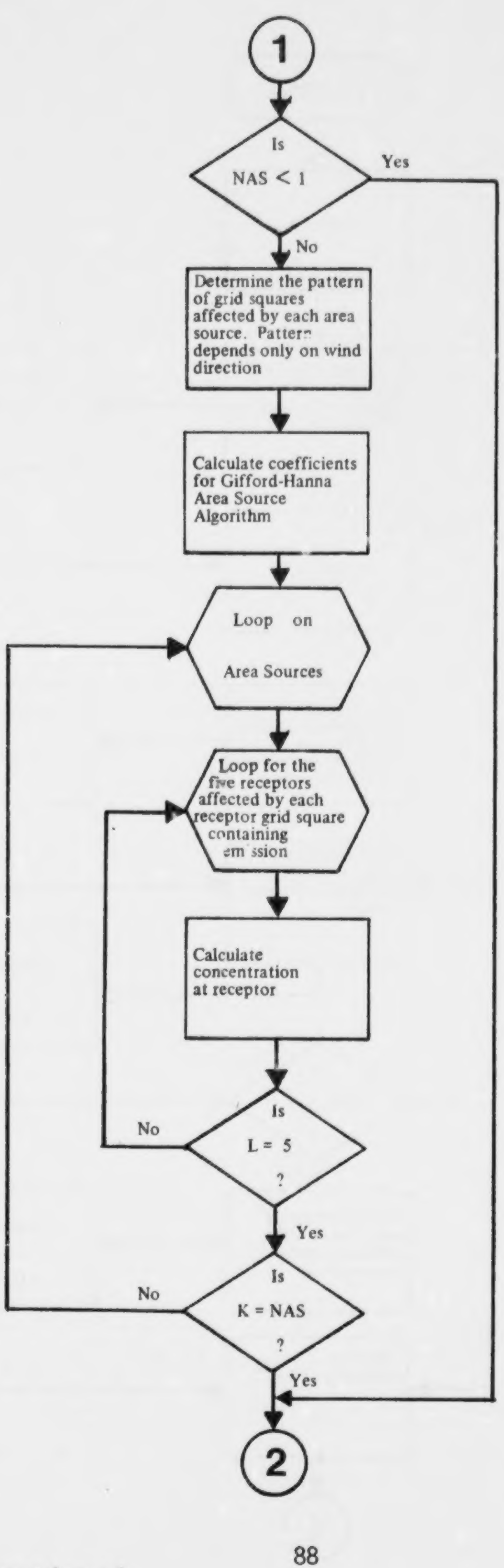

1
Is
NAS < 1
Yes
No
Determine the pattern of grid squares affected by each area source. Pattern depends only on wind direction
Calculate coefficients for Gifford-Hanna Area Source Algorithm
Loop on Area Sources
Loop for the five receptors affected by each receptor grid square containing emission
Calculate concentration at receptor
Is L = 5 ?
No
Yes
Is K = NAS ?
No
Yes
2

Figure 4-1 continued

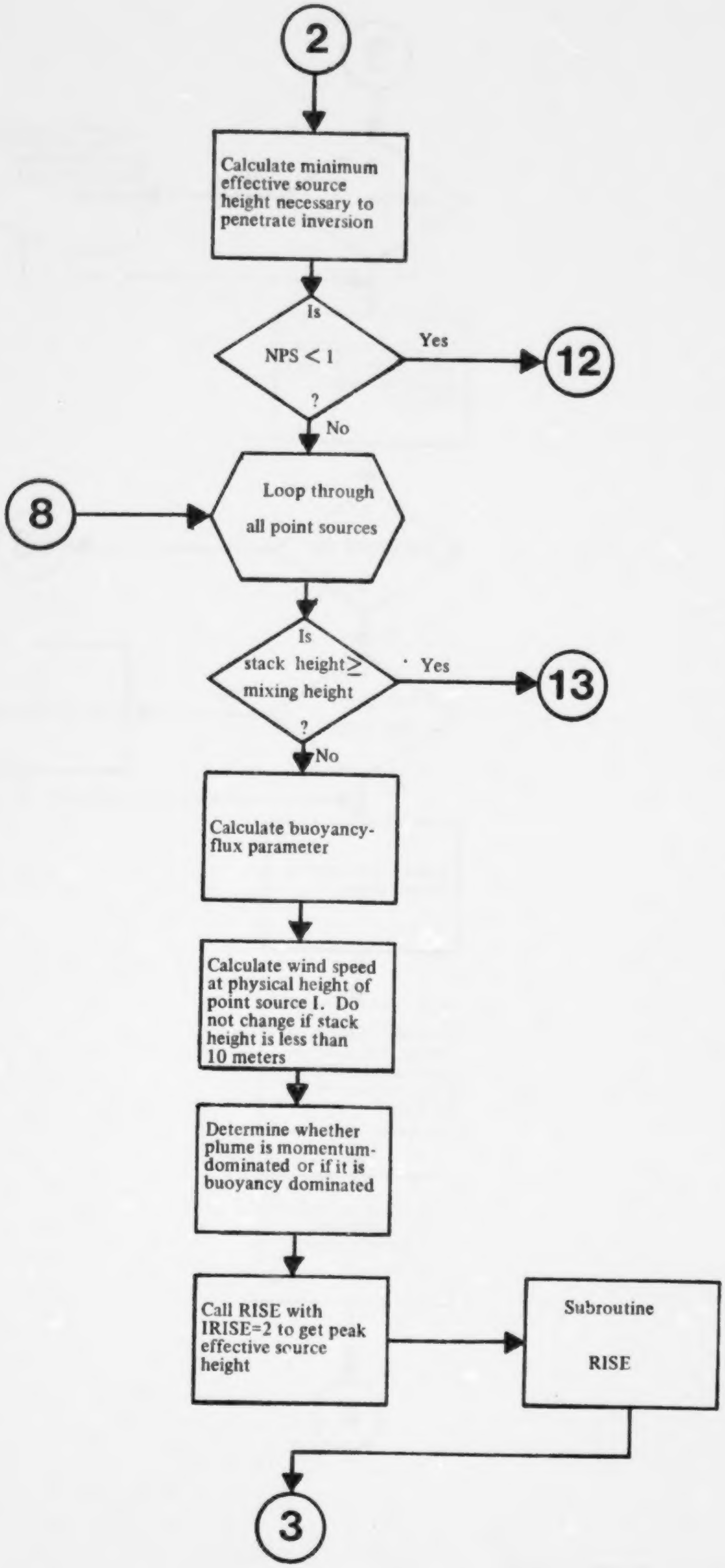

2
Calculate minimum effective source height necessary to penetrate inversion
Is NPS < 1 ?
Yes
12
No
8
Loop through all point sources
Is stack height ≥ mixing height ?
Yes
13
No
Calculate buoyancy-flux parameter
Calculate wind speed at physical height of point source I. Do not change if stack height is less than 10 meters
Determine whether plume is momentum-dominated or if it is buoyancy dominated
Call RISE with IRISE=2 to get peak effective source height
Subroutine RISE
3

Figure 4-1 continued

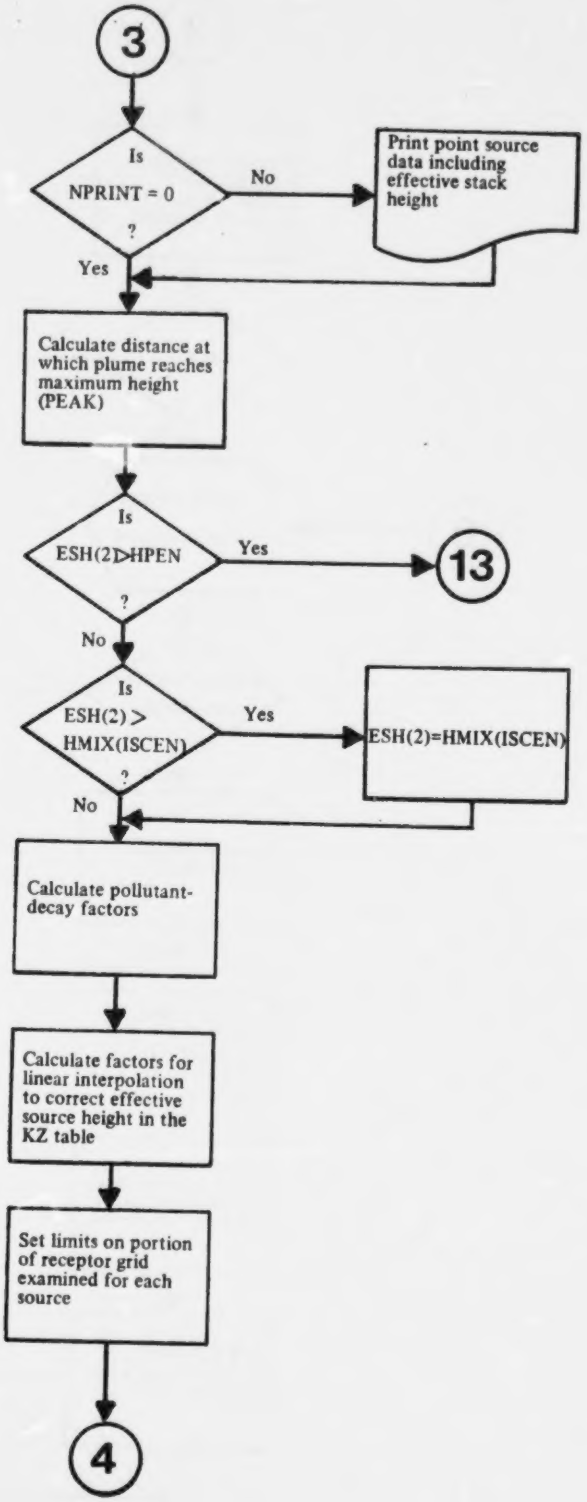

3
Is
NPRINT = 0
?
No
Print point source data including effective stack height
Yes
Calculate distance at which plume reaches maximum height (PEAK)
Is
ESH(2)>HPEN
?
Yes
13
No
Is
ESH(2) >
HMIX(ISCEN)
?
Yes
ESH(2)=HMIX(ISCEN)
No
Calculate pollutant-decay factors
Calculate factors for linear interpolation to correct effective source height in the KZ table
Set limits on portion of receptor grid examined for each source
4

Figure 4-1 continued

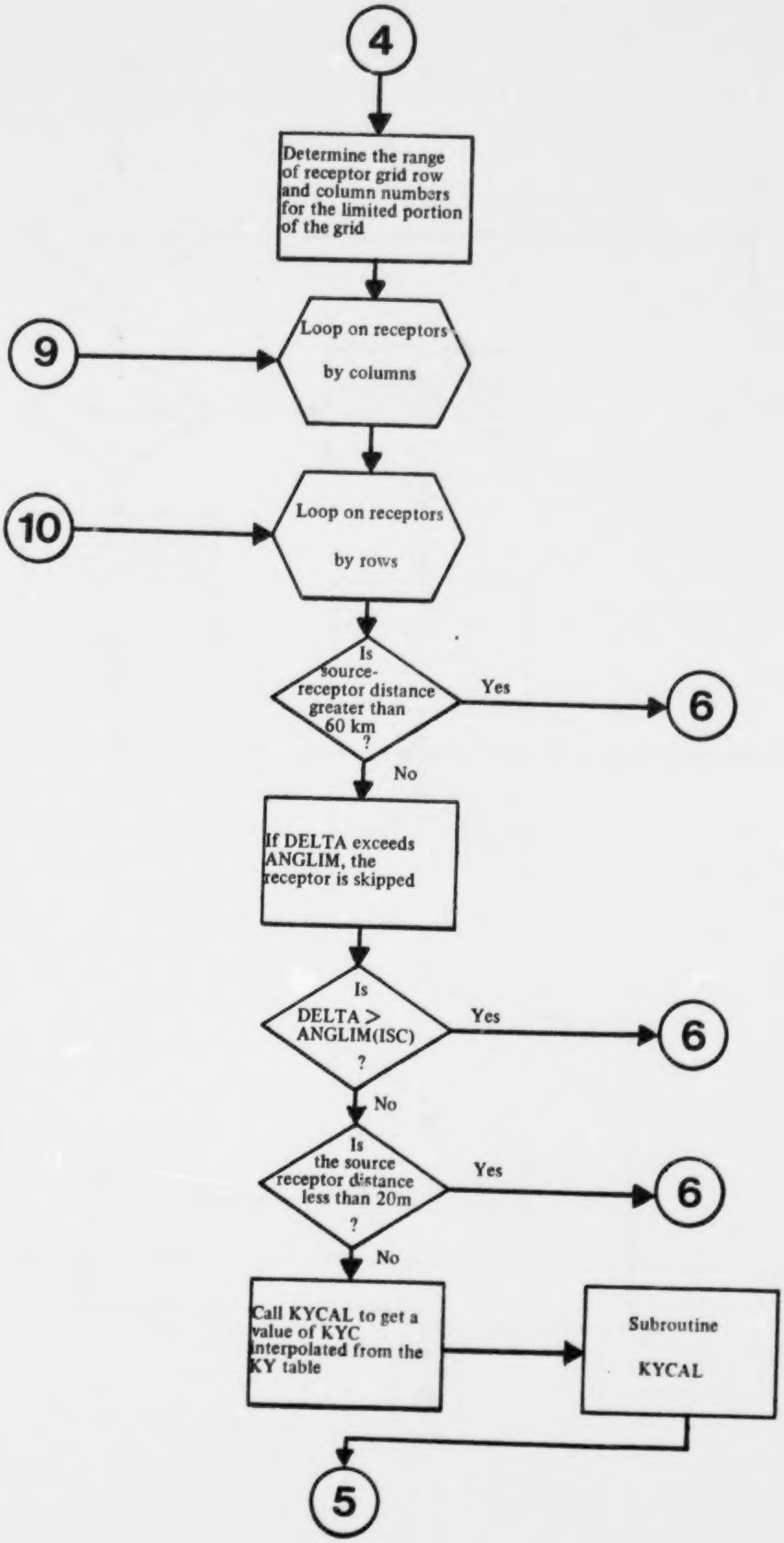

4
Determine the range of receptor grid row and column numbers for the limited portion of the grid
9
Loop on receptors by columns
10
Loop on receptors by rows
Is source-receptor distance greater than 60 km ?
Yes
6
No
If DELTA exceeds ANGLIM, the receptor is skipped
Is DELTA > ANGLIM(ISC) ?
Yes
6
No
Is the source receptor distance less than 20m ?
Yes
6
No
Call KYCAL to get a value of KYC interpolated from the KY table
Subroutine KYCAL
5

Figure 4-1 continued

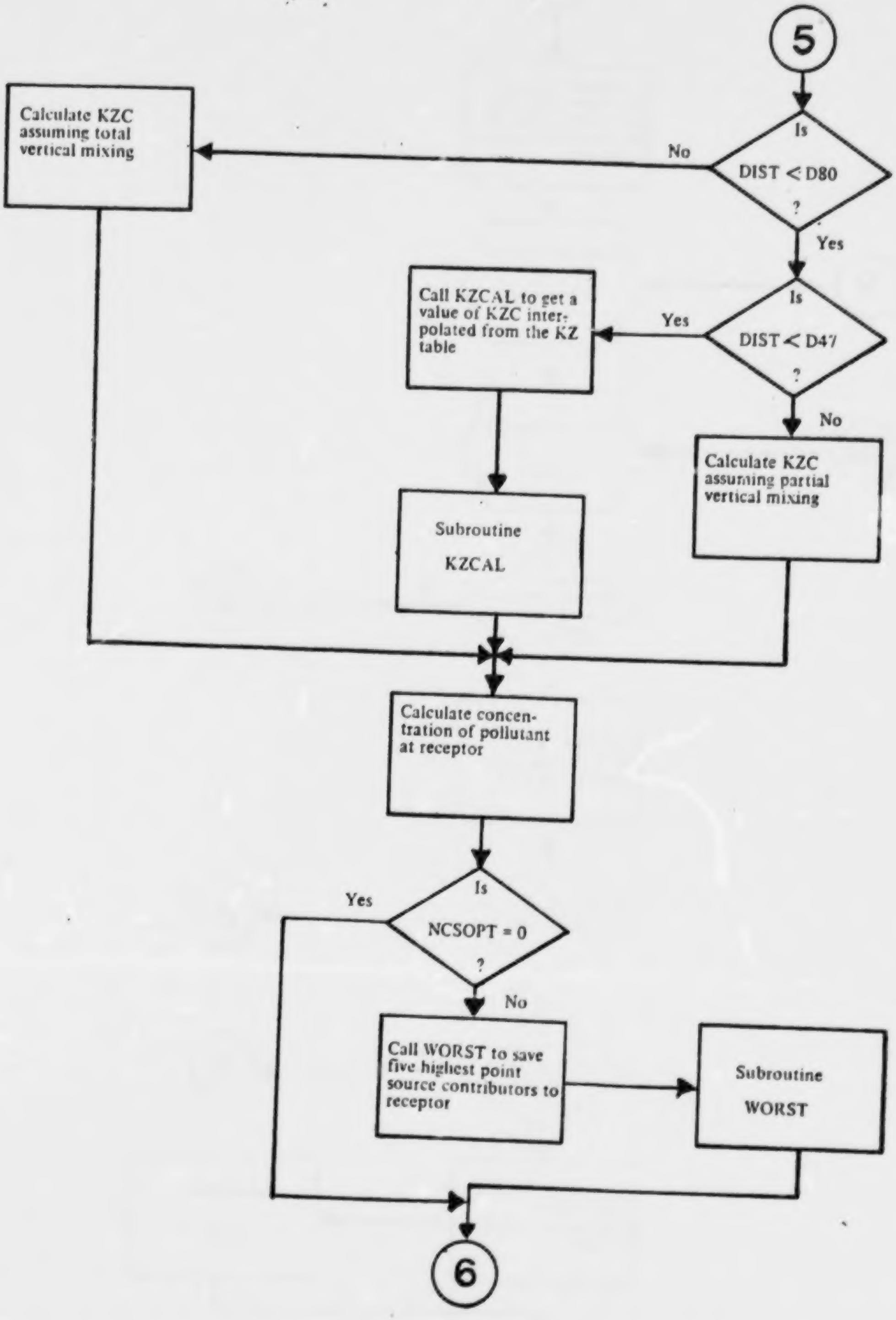

5
Is
DIST < D80
?
No
Yes
Calculate KZC assuming total vertical mixing
Is
DIST < D47
?
Yes
No
Call KZCAL to get a value of KZC interpolated from the KZ table
Subroutine
KZCAL
Calculate KZC assuming partial vertical mixing
Calculate concentration of pollutant at receptor
Is
NCSOPT = 0
?
Yes
No
Call WORST to save five highest point source contributors to receptor
Subroutine
WORST
6

Figure 4-1 continued

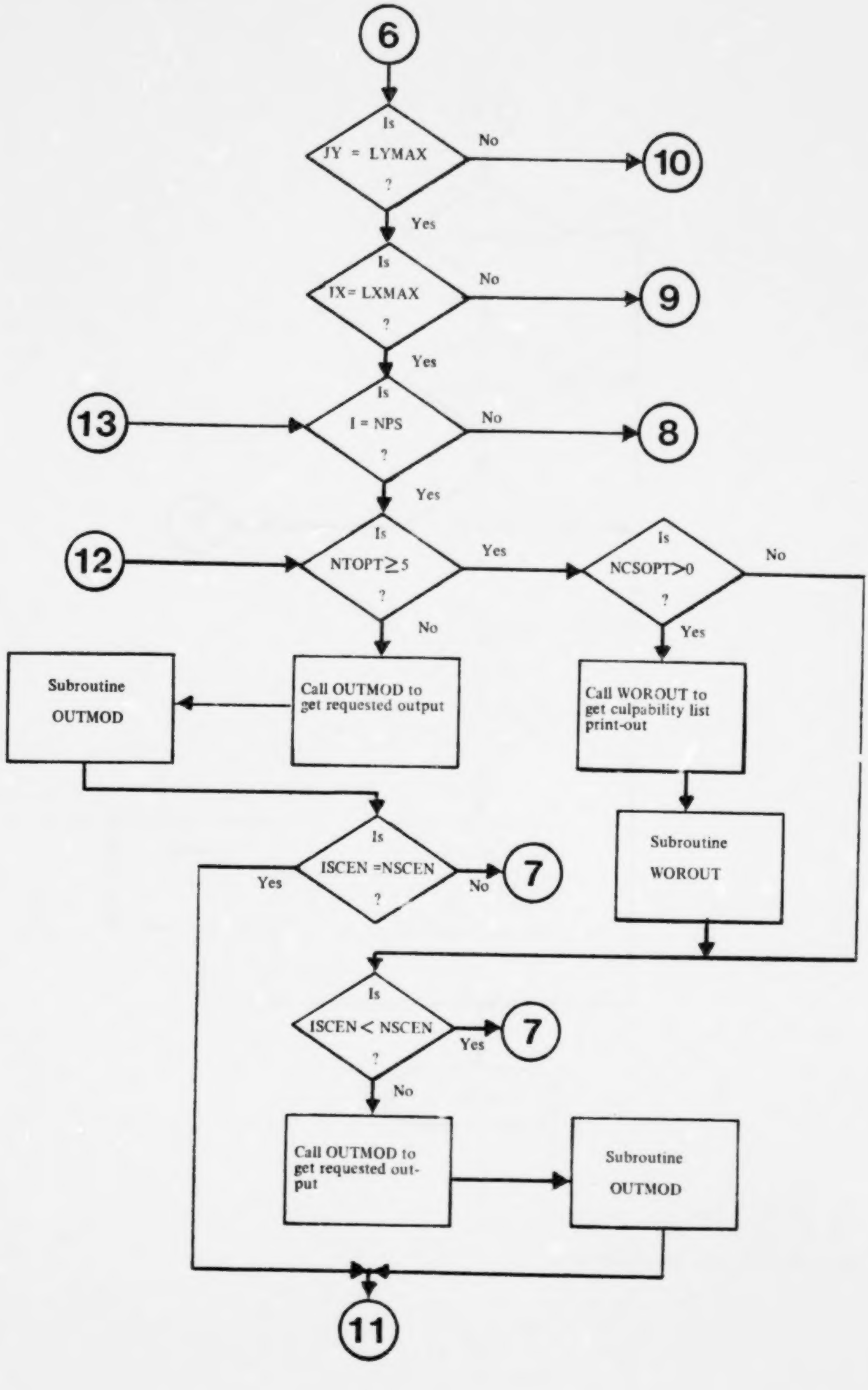
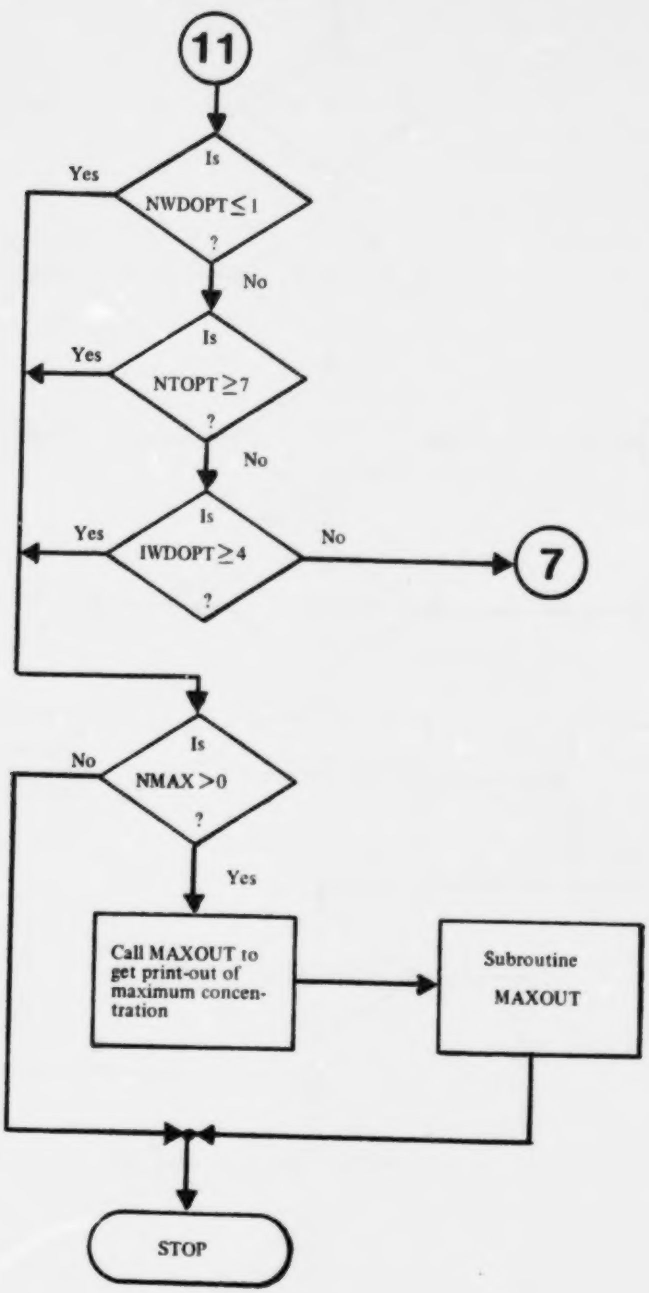

6
Is
JY = LYMAX
?
No
10
Yes
Is
IX= LXMAX
?
No
9
Yes
13
Is
I = NPS
?
No
8
Yes
12
Is
NTOPT≥5
?
Yes
Is
NCSOPT>0
?
No
No
Yes
Subroutine
OUTMOD
Call OUTMOD to get requested output
Call WOROUT to get culpability list print-out
Subroutine
WOROUT
Is
ISCEN =NSCEN
?
Yes
No
7
Is
ISCEN < NSCEN
?
Yes
7
No
Call OUTMOD to get requested out-put
Subroutine
OUTMOD
11

Figure 4-1 continued


11
Is
NWDOPT ≤ 1
?
Yes
No
Is
NTOPT ≥ 7
?
Yes
No
Is
IWDOPT ≥ 4
?
Yes
No
7
Is
NMAX > 0
?
No
Yes
Call MAXOUT to get print-out of maximum concentration
Subroutine MAXOUT
STOP

Fingure 4-1 continued

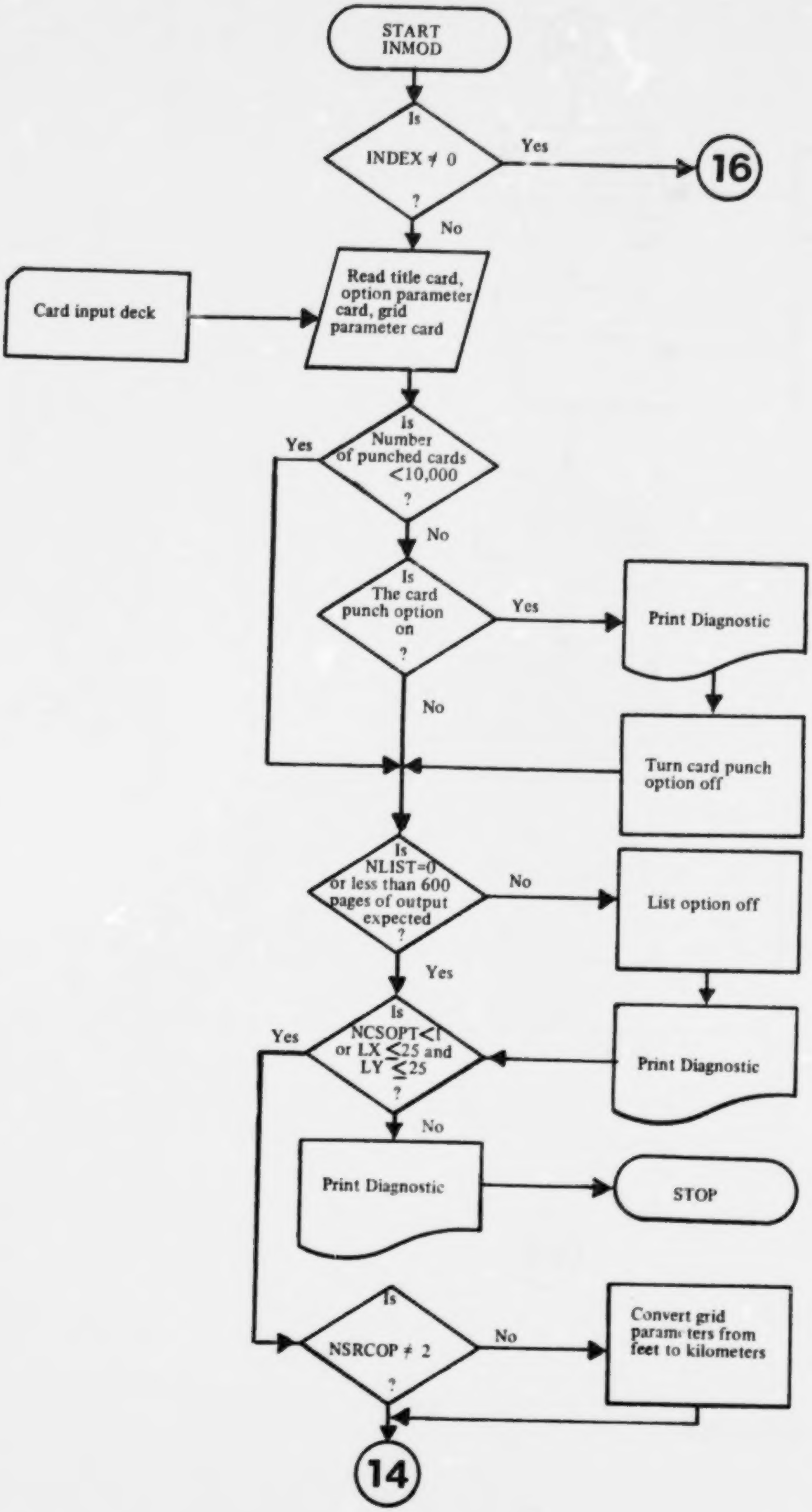

START INMOD
Is INDEX ≠ 0 ?
Yes
16
No
Card input deck
Read title card, option parameter card, grid parameter card
Is Number of punched cards <10,000 ?
Yes
No
Is The card punch option on ?
Yes
Print Diagnostic
No
Turn card punch option off
Is NLIST=0 or less than 600 pages of output expected ?
No
List option off
Yes
Print Diagnostic
Is NCSOPT<1 or LX ≤25 and LY ≤25 ?
Yes
No
Print Diagnostic
STOP
Is NSRCOP ≠ 2 ?
No
Convert grid parameters from feet to kilometers
14

Figure 4-2 Subroutine INMOD

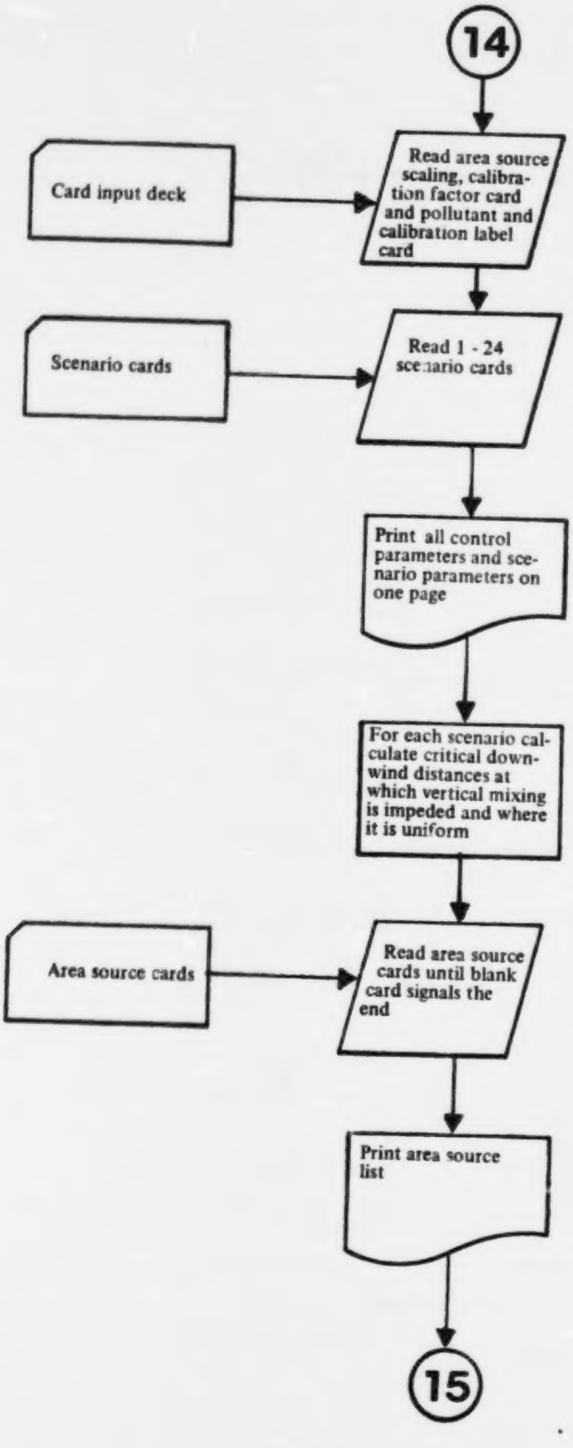

14
Card input deck
Read area source scaling, calibration factor card and pollutant and calibration label card
Scenario cards
Read 1 - 24 scenario cards
Print all control parameters and scenario parameters on one page
For each scenario calculate critical downwind distances at which vertical mixing is impeded and where it is uniform
Area source cards
Read area source cards until blank card signals the end
Print area source list
15

Figure 4-2 Continued

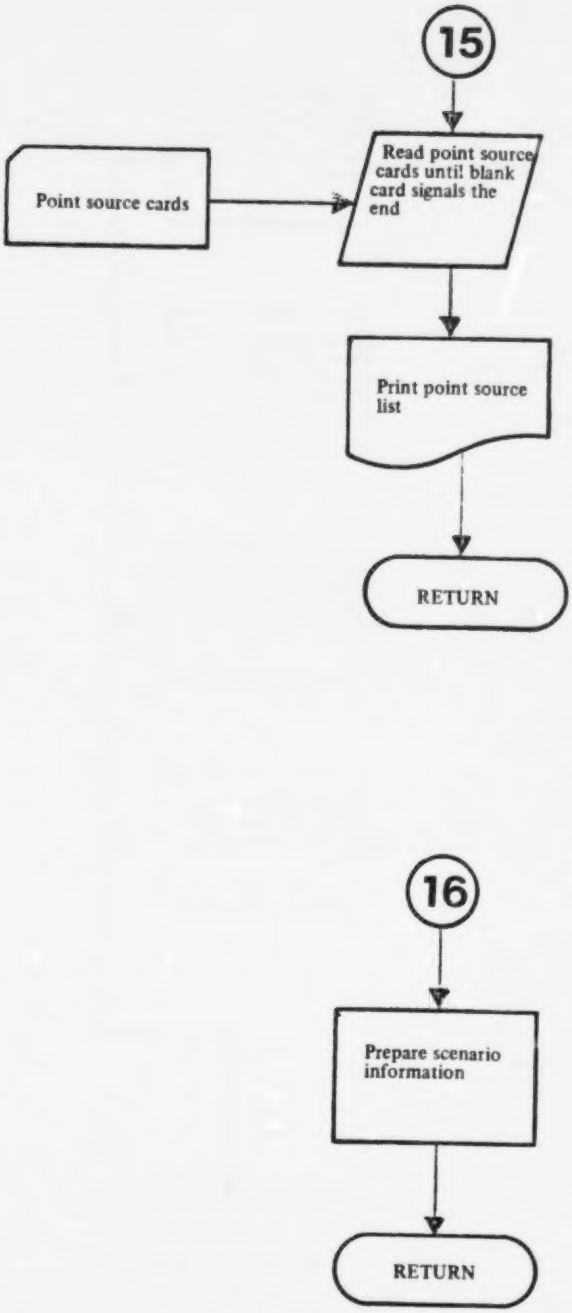

15
Point source cards
Read point source cards until blank card signals the end
Print point source list
RETURN
16
Prepare scenario information
RETURN

Figure 4-2 continued

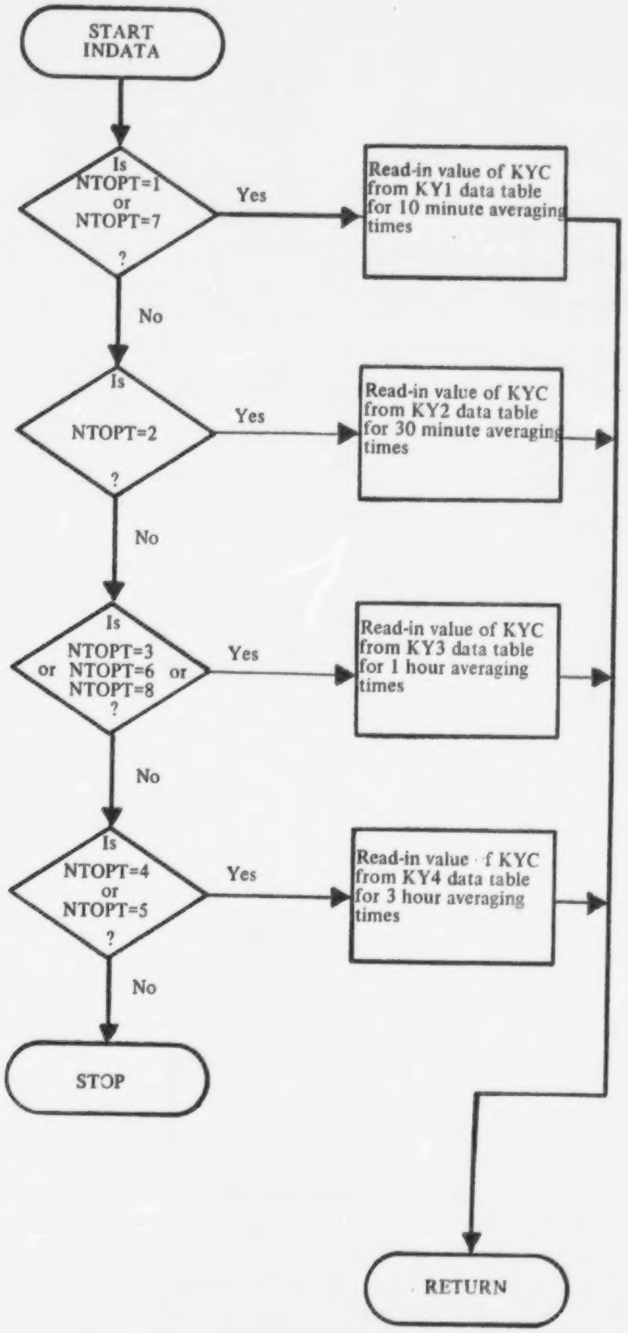

START
INDATA
Is
NTOPT=1
or
NTOPT=7
?
Yes
Read-in value of KYC from KY1 data table for 10 minute averaging times
No
Is
NTOPT=2
?
Yes
Read-in value of KYC from KY2 data table for 30 minute averaging times
No
Is
NTOPT=3
or NTOPT=6 or
NTOPT=8
?
Yes
Read-in value of KYC from KY3 data table for 1 hour averaging times
No
Is
NTOPT=4
or
NTOPT=5
?
Yes
Read-in value of KYC from KY4 data table for 3 hour averaging times
No
STOP
RETURN

Figure 4-3 Subroutine INDATA

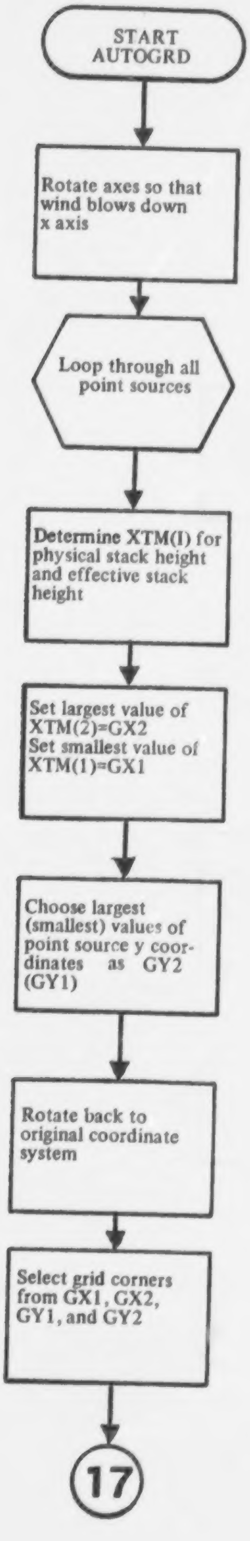

START AUTOGRD
Rotate axes so that wind blows down x axis
Loop through all point sources
Determine XTM(I) for physical stack height and effective stack height
Set largest value of XTM(2)=GX2 Set smallest value of XTM(1)=GX1
Choose largest (smallest) values of point source y coordinates as GY2 (GY1)
Rotate back to original coordinate system
Select grid corners from GX1, GX2, GY1, and GY2
17

Figure 4-4 Subroutine AUTGRD

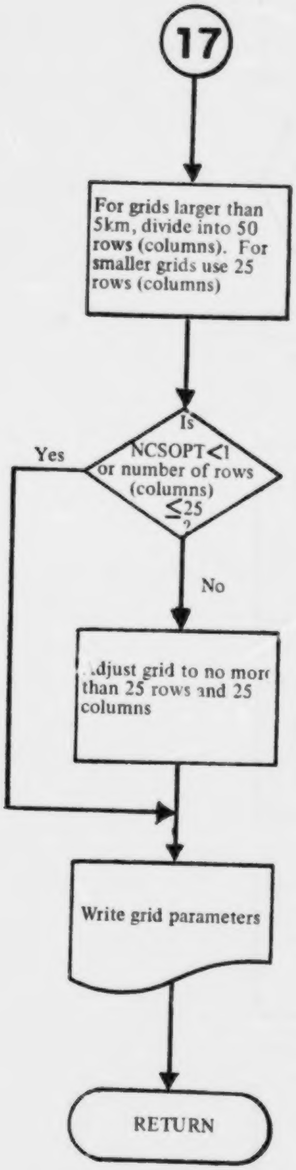

17
For grids larger than 5km, divide into 50 rows (columns). For smaller grids use 25 rows (columns)
Is NCSOPT<1 or number of rows (columns) ≤25 ?
Yes
No
Adjust grid to no more than 25 rows and 25 columns
Write grid parameters
RETURN

Figure 4-4 continued

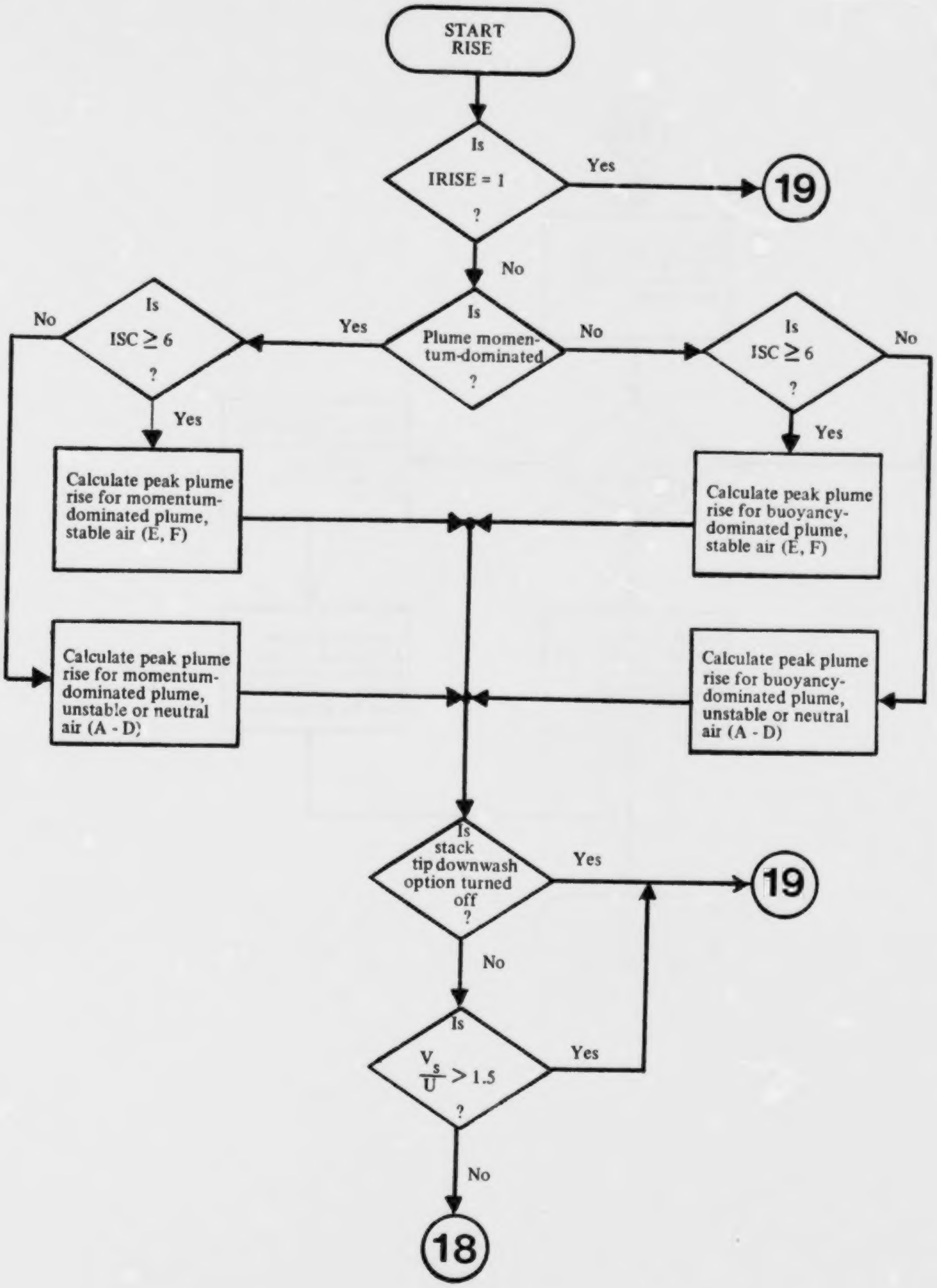

START RISE
Is IRISE = 1 ?
Yes
19
No
Is Plume momentum-dominated ?
Yes
No
Is ISC ≥ 6 ?
No
Yes
Is ISC ≥ 6 ?
Yes
No
Calculate peak plume rise for momentum-dominated plume, stable air (E, F)
Calculate peak plume rise for buoyancy-dominated plume, stable air (E, F)
Calculate peak plume rise for momentum-dominated plume, unstable or neutral air (A - D)
Calculate peak plume rise for buoyancy-dominated plume, unstable or neutral air (A - D)
Is stack tip downwash option turned off ?
Yes
19
No
Is $\frac{V_s}{U} > 1.5$?
Yes
No
18

Figure 4-5 Subroutine RISE

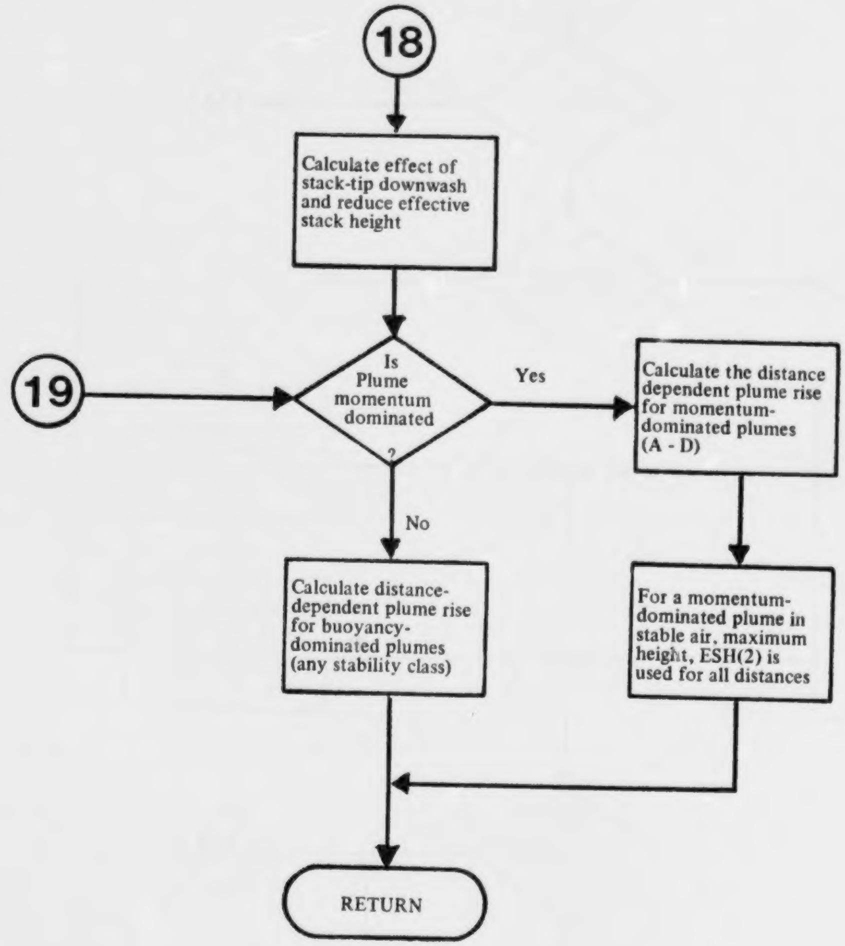

18
Calculate effect of stack-tip downwash and reduce effective stack height
19
Is Plume momentum dominated ?
Yes
Calculate the distance dependent plume rise for momentum-dominated plumes (A - D)
No
Calculate distance-dependent plume rise for buoyancy-dominated plumes (any stability class)
For a momentum-dominated plume in stable air, maximum height, ESH(2) is used for all distances
RETURN

Figure 4-5 continued

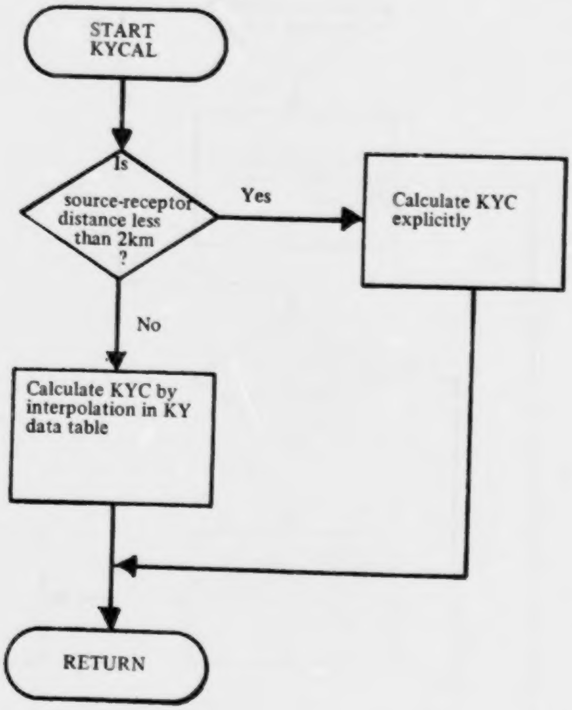

START KYCAL
Is source-receptor distance less than 2km ?
Yes
Calculate KYC explicitly
No
Calculate KYC by interpolation in KY data table
RETURN

Figure 4-6 Subroutine KYCAL

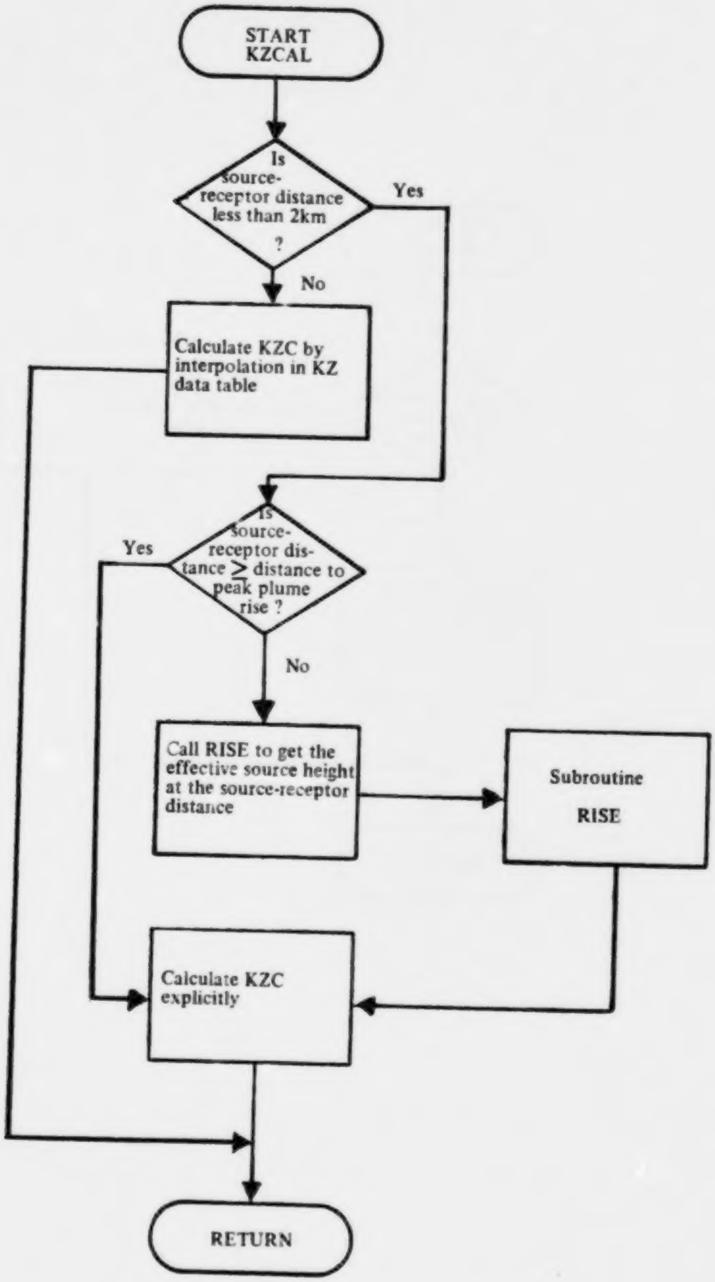

START KZCAL
Is source-receptor distance less than 2km ?
Yes
No
Calculate KZC by interpolation in KZ data table
Is source-receptor distance ≥ distance to peak plume rise ?
Yes
No
Call RISE to get the effective source height at the source-receptor distance
Subroutine RISE
Calculate KZC explicitly
RETURN

Figure 4-7 Subroutine KZCAL

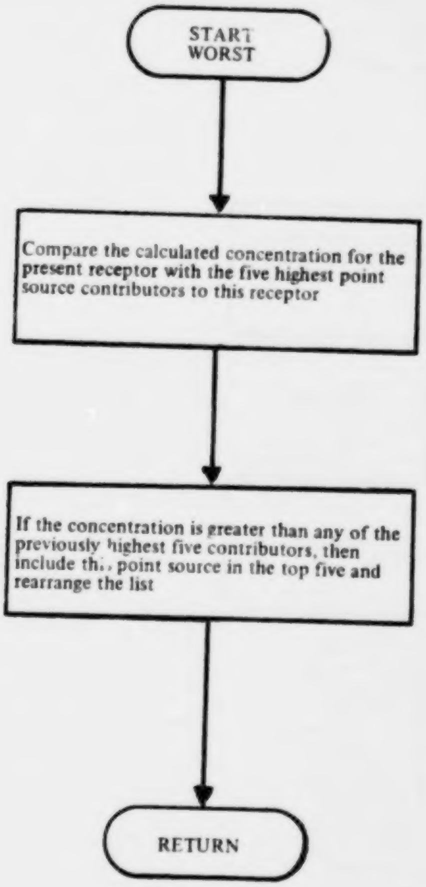

START WORST
Compare the calculated concentration for the present receptor with the five highest point source contributors to this receptor
If the concentration is greater than any of the previously highest five contributors, then include this point source in the top five and rearrange the list
RETURN

Figure 4-8 Subroutine WORST

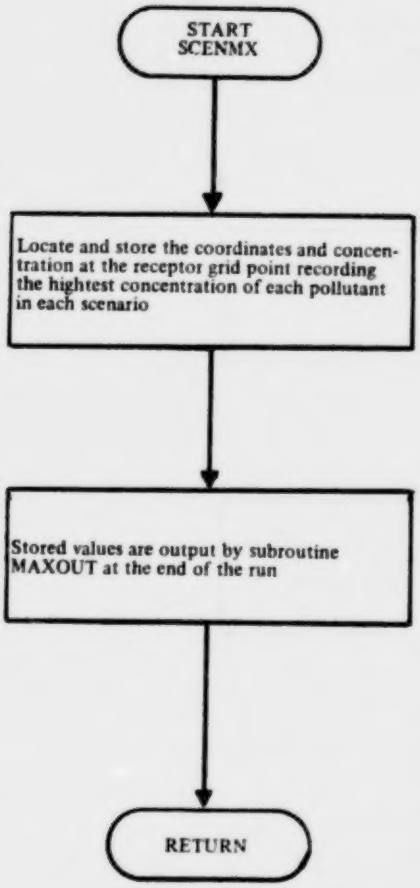

START
SCENMX
Locate and store the coordinates and concentration at the receptor grid point recording the hightest concentration of each pollutant in each scenario
Stored values are output by subroutine MAXOUT at the end of the run
RETURN

Figure 4-9 Subroutine SCENMX

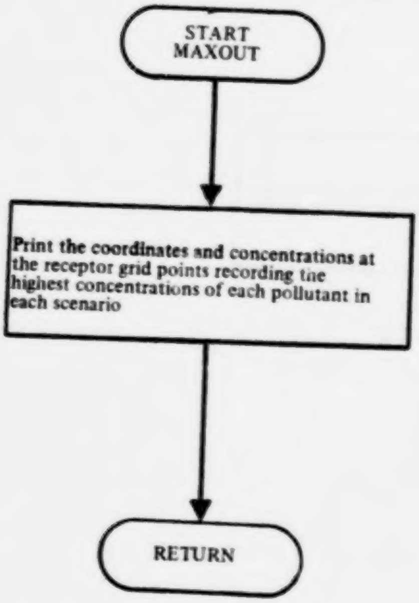

START MAXOUT
Print the coordinates and concentrations at the receptor grid points recording the highest concentrations of each pollutant in each scenario
RETURN

Figure 4-10 Subroutine MAXOUT

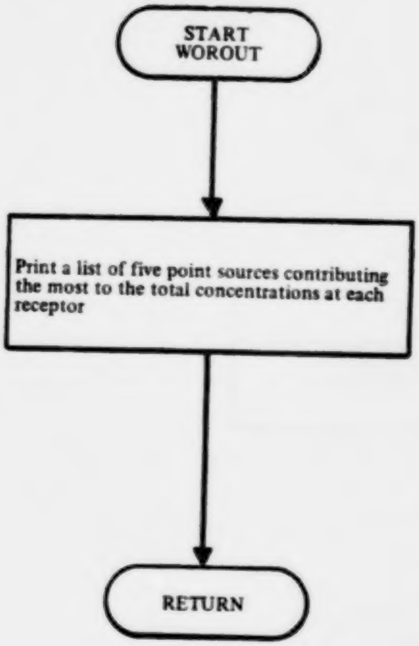

START
WOROUT
Print a list of five point sources contributing the most to the total concentrations at each receptor
RETURN

Figure 4-11 Subroutine WOROUT

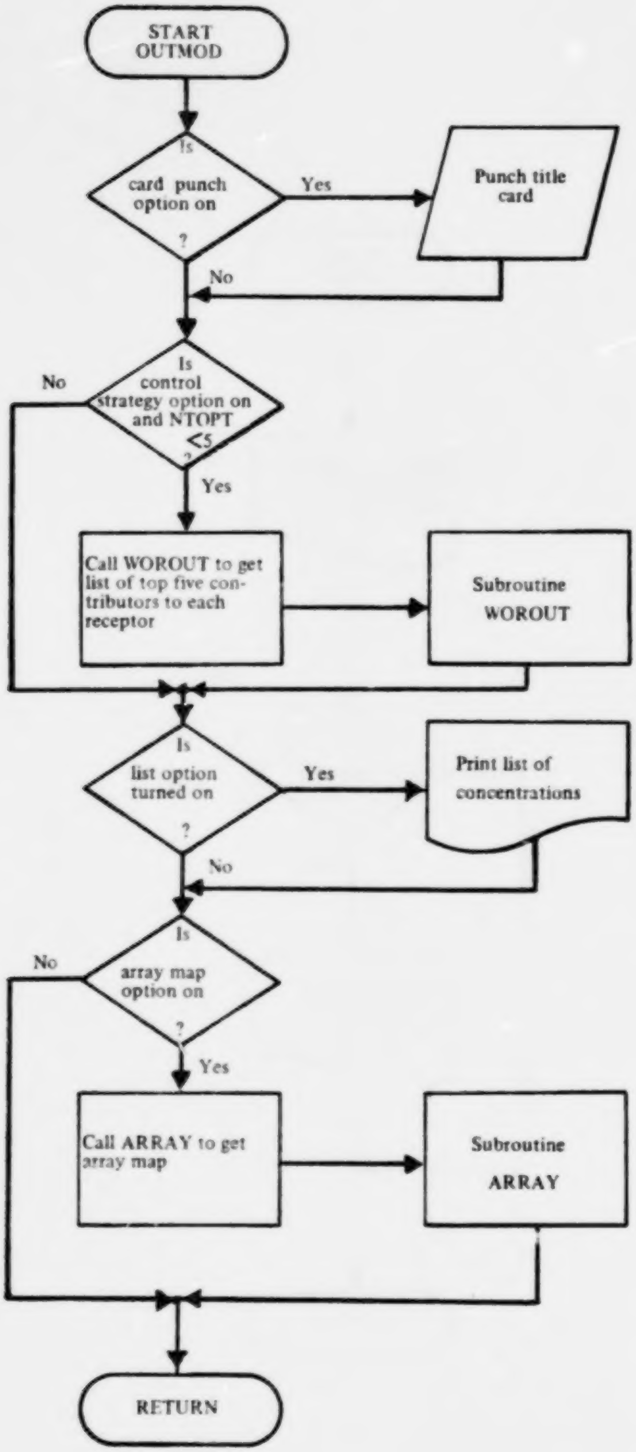

START OUTMOD
Is card punch option on ?
Yes
Punch title card
No
Is control strategy option on and NTOPT <5 ?
No
Yes
Call WOROUT to get list of top five contributors to each receptor
Subroutine WOROUT
Is list option turned on ?
Yes
Print list of concentrations
No
Is array map option on ?
No
Yes
Call ARRAY to get array map
Subroutine ARRAY
RETURN

Figure 4-12 Subroutine OUTMOD

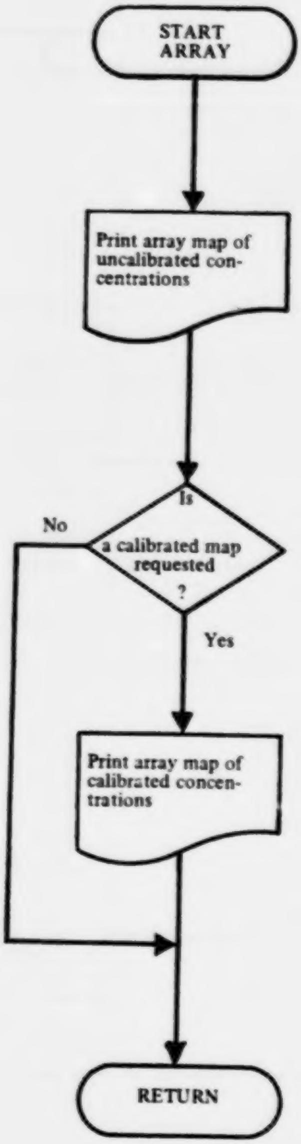

START
ARRAY
Print array map of uncalibrated concentrations
Is a calibrated map requested ?
No
Yes
Print array map of calibrated concentrations
RETURN

Figure 4-13 Subroutine ARRAY

APPENDIX A

General Form of the Gaussian Equation

The most general form of the Gaussian dispersion equation is:

$$\chi(x,y,z,H) = \frac{Q}{2\pi U\sigma_y\sigma_z} \exp\left[-\frac{y^2}{2\sigma_y^2}\right] \left\{\exp\left[-\frac{(z-H)^2}{2\sigma_z^2}\right] + \exp\left[-\frac{(z+H)^2}{2\sigma_z^2}\right]\right\} \quad (28)$$

For ground level concentrations z=0 and equation (28) simplifies to:

$$\chi(x,y,0,H) = \frac{Q}{\pi U\sigma_y\sigma_z} \exp\left[-\frac{y^2}{2\sigma_y^2}\right] \exp\left[-\frac{H^2}{2\sigma_z^2}\right] \quad (29)$$

APPENDIX B

Section 1 Time Averaging Period Adjustment

The method used in TEM-8 to adjust the horizontal dispersion coefficient (σ_y) values from 10 minute averaging times to longer averaging periods has evolved from Singer's original work [8] on peak-to-mean concentration conversion. Originally, TEM-5 used Turner's [3] method to adjust the calculated 10 minute concentrations to longer averaging times. The method used in TEM-5 was:

$$\chi_t = \chi_0 \left(\frac{10}{t}\right)^{R(S)} \tag{30}$$

where:

χ_0 is the calculated 10 minute concentration
χ_t is the concentration for averaging time, t
t is the averaging time in minutes
R(S) is a function of atmospheric stability class, S

Recently in a summary of recommendations by the American Meteorological Society Workshop on Stability Classification Schemes and Sigma Curves [6] a method for adjusting time averaging periods by adjusting the horizontal spread (σ_y) of the plume was suggested by Gifford [16]. This method is:

$$\sigma_{y_t} = \frac{\sigma_{y_0}}{\left(\frac{10}{t}\right)^{q(S)}} \tag{31}$$

where:

σ_{y_0} is the horizontal dispersion coefficient for a 10 minute time averaging period

σ_{y_t} is the adjusted horizontal dispersion coefficient for time averaging period, t

q(S) is a function of atmospheric stability class, S

Since the Gaussian plume equation for the plume centerline concentration at ground level is

$$\chi = \frac{Q}{\pi U \sigma_z \sigma_{y_0}} \exp\left[-\frac{H^2}{2\sigma_z^2}\right] \qquad (32)$$

then the same time adjusted concentration, χ_t, will result when R(S) is substituted for q(S) in equation (31) and σ_{y_0} is replaced by σ_{y_t} in equation (32).

In earlier versions of the TEM, equation (30) was used for all crosswind distances to convert 10 minute time period concentrations to average concentrations for longer time periods. This method incorrectly reduced the off centerline concentrations. TEM-8 uses equation (31), so the mass of the plume is conserved when adjustments are made to longer averaging periods. See Section 2 of Appendix B.

The values of R(S) were determined by Caraway [9] from data provided in Singer [8]. In Singer's article, a figure is presented that shows the relationship between peak-to-mean concentrations and gustiness (which is an indication of stability class). The three classes of gustiness shown by Singer, B_2, B_1, and C, correspond to stability classes B, C, and D respectively, A more general form of equation (30) is

$$\chi_t = \chi_0 \left(\frac{t_0}{t}\right)^{R(S)}$$

where all variables are as defined in equation (30) except t_0 is the time averaging period for χ_0. Solving for R(S) one has:

$$R(S) = \frac{\ln\left(\frac{\chi_t}{\chi_0}\right)}{\ln\left(\frac{t_0}{t}\right)} \qquad (33)$$

Data from Singer's work was used to determine R(S) as a function of B, C, and D atmospheric stability classes. These values for R(S) were plotted versus S, and a straight line was fitted between them, so that values for stability classes A, E, and F could be determined. See Figure B-1. Values for R(S) used in TEM-8 are reported in Table 2-3.

The values used for R(S) were obtained from early work and may be subject to change if further research is performed. It has been suggested that with E and F atmospheric stability classes a plume will at times meander more than described by the value of R(S) being used at this time.

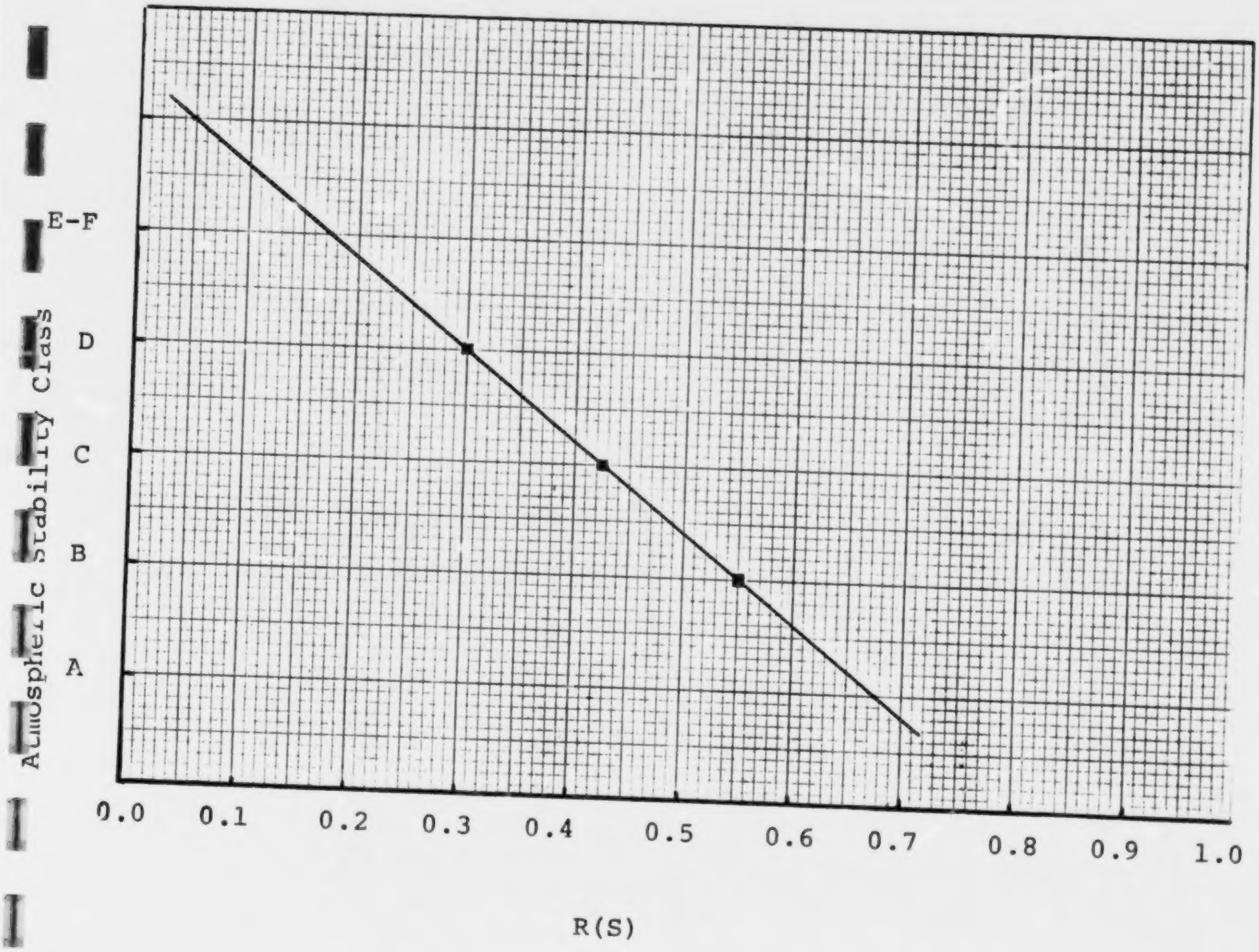


Figure B-1. Relationship Between Atmospheric Stability Class and R(S)

Section 2 Conservation of Mass in Plume Cross Section Profile

For the TEM-8, the method used for adjusting the time averaging period adjusts the value of σ_y. To show that the plume mass is conserved, integrate the equation for plume cross section concentration from $y=-\infty$ to $y=+\infty$ with the original 10 minute value for σ_y and show that it equals the analogous integration performed with the adjusted value of σ_y. From equations (1) and (4)

$$\int_{-\infty}^{+\infty} \chi_t(x,y)dy = \int_{-\infty}^{+\infty} \frac{Q}{U\pi\sigma_z \dfrac{\sigma_y}{\left(\frac{10}{t}\right)^{R(S)}}} \exp\left[-\frac{H^2}{2\sigma_z^2}\right] \exp\left[-\frac{y^2}{2\left[\dfrac{\sigma_y}{\left(\frac{10}{t}\right)^{R(S)}}\right]^2}\right] dy \qquad (34)$$

$$= \frac{Q\left(\frac{10}{t}\right)^{R(S)}}{U\pi\sigma_z\sigma_y} \exp\left[-\frac{H^2}{2\sigma_z^2}\right] \int_{-\infty}^{+\infty} \exp\left[-\frac{1}{2}\left[\frac{y\left(\frac{10}{t}\right)^{R(S)}}{\sigma_y}\right]^2\right] dy \qquad (35)$$

Now

$$\int_{0}^{+\infty} \exp\,(-a^2x^2)dx = \frac{1}{2a}\sqrt{\pi} \qquad (36)$$

$$\int_{-\infty}^{+\infty} \exp\,(-a^2x^2)dx = 2\int_{0}^{+\infty} \exp\,(-a^2x^2)dx = \frac{1}{a}\sqrt{\pi}$$

Thus

$$\int_{-\infty}^{+\infty} \exp\left[-\frac{1}{2}\left[\frac{y\left(\frac{10}{t}\right)^{R(S)}}{\sigma_y}\right]^2\right] dy = \int_{-\infty}^{+\infty} \exp\left[-\left[\frac{\left(\frac{10}{t}\right)^{R(S)}}{\sqrt{2}\,\sigma_y}\right]^2 y^2\right] dy =$$

$$\frac{1}{\dfrac{\left(\frac{10}{t}\right)^{R(S)}}{\sqrt{2}\,\sigma_y}}\sqrt{\pi} \quad = \quad \frac{1}{\left(\frac{10}{t}\right)^{R(S)}}\sqrt{2\pi}\;\sigma_y$$

Then substituting into equation (35) we have

$$\int_{-\infty}^{+\infty} \chi_t(x,y)dy = \frac{Q\left(\frac{10}{t}\right)^{R(S)}}{U\pi\sigma_z\sigma_y} \quad \exp\left[-\frac{H^2}{2\sigma_z^2}\right]\frac{1}{\left(\frac{10}{t}\right)^{R(S)}}\sqrt{2\pi}\;\sigma_y$$

$$= \frac{\sqrt{2}\,Q}{U\sqrt{\pi}\,\sigma_z} \quad \exp\left[-\frac{H^2}{2\sigma_z^2}\right] \qquad (37)$$

Now, integrating the original ten minute averaged plume profile

$$\int_{-\infty}^{+\infty} \chi(x,y)dy = \int_{-\infty}^{+\infty}\frac{Q}{U\pi\sigma_z\sigma_y} \quad \exp\left[-\frac{H^2}{2\sigma_z^2}\right] \quad \exp\left[-\frac{y^2}{2\sigma_y^2}\right] \quad dy$$

$$= \frac{Q}{U\pi\sigma_z\sigma_y} \quad \exp\left[-\frac{H^2}{2\sigma_z^2}\right] \quad \int_{-\infty}^{+\infty}\exp\left[-\frac{y^2}{2\sigma_y^2}\right] \quad dy$$

But

$$\int_{-\infty}^{+\infty} \exp\left[-\frac{y^2}{2\sigma_y^2}\right] dy = \int_{-\infty}^{+\infty} \exp\left[-\left[\frac{1}{\sqrt{2}\,\sigma_y}\right]^2 y^2\right] dy = \sqrt{2\pi}\,\sigma_y \qquad (38)$$

Thus

$$\int_{-\infty}^{+\infty} \chi(x,y)dy = \frac{Q}{U\pi\sigma_z\sigma_y} \exp\left[-\frac{H^2}{2\sigma_z^2}\right]\sqrt{2\pi}\,\sigma_y$$

$$= \frac{\sqrt{2}\,Q}{U\sqrt{\pi}\,\sigma_z} \exp\left[-\frac{H^2}{2\sigma_z^2}\right] \qquad (39)$$

Therefore, from equations (37) and (39)

$$\int_{-\infty}^{+\infty} \chi_t(x,y)dy = \int_{-\infty}^{+\infty} \chi(x,y)dy$$

APPENDIX C

Average Concentration with a Limit to Vertical Mixing

To determine the average concentration in the mixing layer after vertical mixing is uniform, one must integrate equation (28) in the vertical from 0 to ∞ and then divide that value by L, the mixing height. For these purposes one can simplify equation (28) by setting H = 0. Then

$$\int_0^\infty \chi(x,y,z,0)dz = \int_0^\infty \frac{Q}{U\pi\sigma_z\sigma_y} \exp\left[-\frac{y^2}{2\sigma_y^2}\right] \exp\left[-\frac{z^2}{2\sigma_z^2}\right] dz \qquad (40)$$

$$= \frac{Q}{U\pi\sigma_z\sigma_y} \exp\left[-\frac{y^2}{2\sigma_y^2}\right] \int_0^\infty \exp\left[-\frac{z^2}{2\sigma_z^2}\right] dz$$

Since

$$\int_0^\infty \exp(-a^2z^2)dz = \frac{\sqrt{\pi}}{2a}$$

$$\int_0^\infty \exp\left[-\frac{z^2}{2\sigma_z^2}\right] dz = \int_0^\infty \exp\left[-\left(\frac{1}{\sqrt{2}\,\sigma_z}\right)^2 z^2\right] dz = \frac{\sqrt{\pi}}{\frac{2}{\sqrt{2}\sigma_z}} = \frac{\sqrt{\pi}}{\sqrt{2}}\,\sigma_z$$

Then

$$\int_0^\infty \chi(x,y,z,0)dz = \frac{Q}{U\pi\sigma_z\sigma_y} \exp\left[-\frac{y^2}{2\sigma_y^2}\right] \frac{\sqrt{\pi}}{\sqrt{2}}\,\sigma_z$$

$$= \frac{Q}{\sqrt{2\pi}U\sigma_y} \exp\left[-\frac{y^2}{2\sigma_y^2}\right] \qquad (41)$$

To obtain the average concentration from $z = 0$ to $z = L$, divide equation (41) by L

$$\bar{\chi}\,(x,y,z,0) = \frac{Q}{\sqrt{2\pi} L \sigma_y U} \quad \exp\left[-\frac{y^2}{2\sigma_y{}^2}\right]$$

APPENDIX D

TEM Area Source Algorithm Derivation

The area source algorithm used in the TEM was developed by Gifford and Hanna [17]. In Appendix B the general form of the Gaussian dispersion equation for ground level concentrations was integrated in the y (cross-wind direction) to obtain equation (37).

$$C = \int_{-\infty}^{\infty} \chi(x,y,H)dy = \sqrt{\frac{2}{\pi}} \frac{Q}{U\sigma_z} \exp\left[-\frac{H^2}{2\sigma_z^{\ 2}}\right] \tag{37}$$

For an area source, emissions are assumed to be emitted at the ground level so

$$C = \sqrt{\frac{2}{\pi}} \frac{Q}{U\sigma_z} \tag{42}$$

Equation (42) represents the total amount of pollutants in the cross section of the plume. Now use

$$\sigma_z = a(S)\ x^{b(S)} \tag{43}$$

to approximate σ_z and substitute into equation (42)

$$C = \sqrt{\frac{2}{\pi}} \frac{1}{Ua(S)} Qx^{-b(S)} \tag{44}$$

Define a rectilinear grid of squares each of the same size with a distance of Δx on each side. (This is done as an input to the TEM.) It is assumed that each area source is the size of one of the grid squares and that the emissions originate in the center of the square. Also it is assumed that the wind blows down the x axis. A receptor is located in the center of the square of interest which contains an area source with an emission rate of Q_0. Other area sources upwind of this source are similarly located in squares with the source of emissions located in the center of each respective square. The emission rate for each of these sources is Q_i. Let i increase with the distance upwind from the receptor and let n be the largest value of i for which Q_i is not zero. A diagram of this source geometry is shown in Figure D-1.

To determine the pollutant concentration at the receptor, integrate equation (44) over x from x = 0 to x = (2n+1)Δx/2.

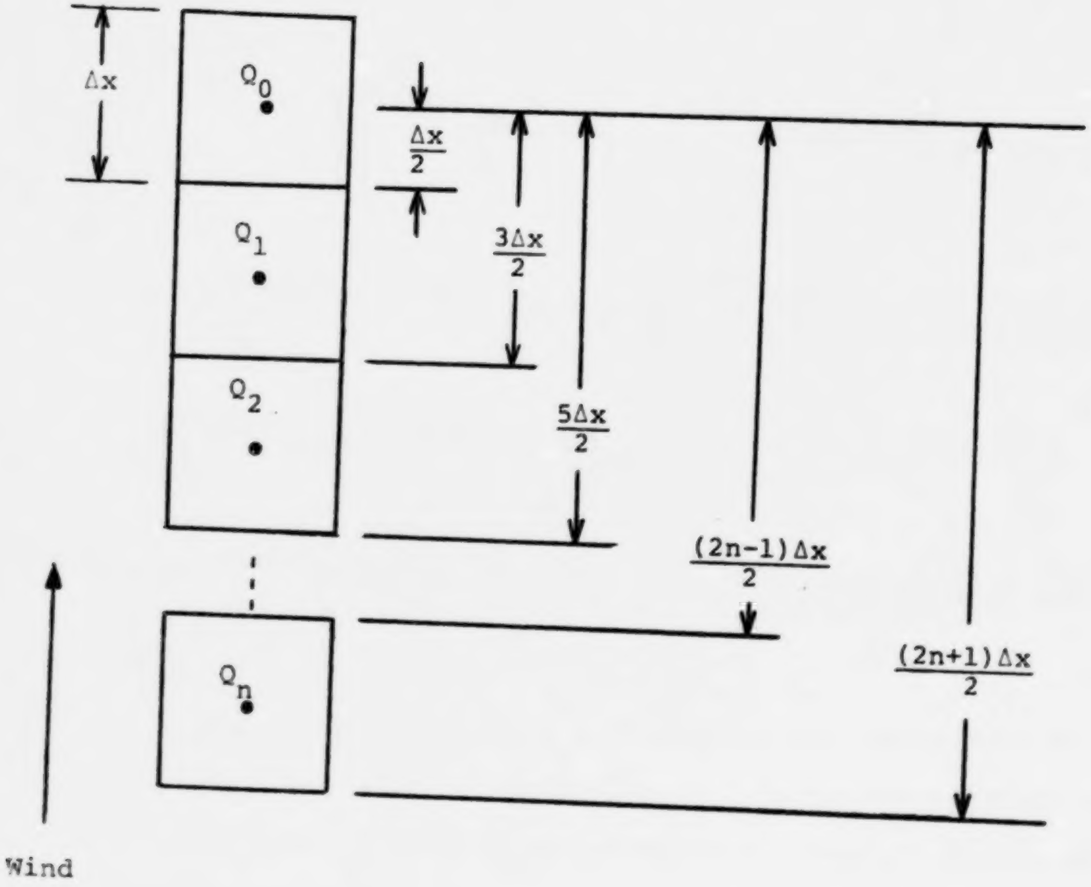
$$C_A = \int_0^{\frac{(2n+1)\Delta x}{2}} C dx$$

$$= \int_0^{\frac{(2n+1)\Delta x}{2}} \sqrt{\frac{2}{\pi}} \frac{1}{Ua(S)} Qx^{-b(S)} dx$$

$$= \sqrt{\frac{2}{\pi}} \frac{1}{Ua(S)} \int_0^{\frac{(2n+1)\Delta x}{2}} Qx^{-b(S)} dx$$

$$= \sqrt{\frac{2}{\pi}} \frac{1}{Ua(S)} \left[\int_0^{\frac{\Delta x}{2}} Qx^{-b(S)} dx + \int_{\frac{\Delta x}{2}}^{\frac{3\Delta x}{2}} Qx^{-b(S)} dx + \int_{\frac{3\Delta x}{2}}^{\frac{5\Delta x}{2}} Qx^{-b(S)} + \ldots \right.$$

$$\left. + \int_{\frac{(2n-1)\Delta x}{2}}^{\frac{(2n+1)\Delta x}{2}} Qx^{-b(S)} dx \right]$$



Δx
Q_0
Q_1
Q_2
Q_n
$\frac{\Delta x}{2}$
$\frac{3\Delta x}{2}$
$\frac{5\Delta x}{2}$
$\frac{(2n-1)\Delta x}{2}$
$\frac{(2n+1)\Delta x}{2}$
Wind

Figure D-1 Area Source Geometry with Upwind Sources

$$
\begin{aligned}
C_A = {} & \sqrt{\frac{2}{\pi}}\,\frac{1}{Ua(S)}\left\{\frac{1}{1-b(S)}\,Q_0\left(\frac{\Delta x}{2}\right)^{1-b(S)} + \frac{1}{1-b(S)}\,Q_1\left[\left(\frac{3\Delta x}{2}\right)^{1-b(S)} - \left(\frac{\Delta x}{2}\right)^{1-b(S)}\right] + \right. \\
& \frac{1}{1-b(S)}\,Q_2\left[\left(\frac{5\Delta x}{2}\right)^{1-b(S)} - \left(\frac{3\Delta x}{2}\right)^{1-b(S)}\right] + \ldots + \\
& \left. \frac{1}{1-b(S)}\,Q_n\left[\left(\frac{(2n+1)\Delta x}{2}\right)^{1-b(S)} - \left(\frac{(2n-1)\Delta x}{2}\right)^{1-b(S)}\right]\right\} \\
= {} & \sqrt{\frac{2}{\pi}}\,\frac{1}{Ua(S)[1-b(S)]}\left(\frac{\Delta x}{2}\right)^{1-b(S)}\left\{Q_0 + Q_1\left[3^{1-b(S)} - 1^{1-b(S)}\right] + \right. \\
& \left. Q_2\left[5^{1-b(S)} - 3^{1-b(S)}\right] + \ldots + Q_n\left[(2n+1)^{1-b(S)} - (2n-1)^{1-b(S)}\right]\right\} \\
= {} & \sqrt{\frac{2}{\pi}}\,\frac{1}{Ua(S)[1-b(S)]}\left(\frac{\Delta x}{2}\right)^{1-b(S)}\left\{Q_0 + \sum_{i=1}^{n} Q_i\left[(2i+1)^{1-b(S)} - (2i-1)^{1-b(S)}\right]\right\}
\end{aligned}
\tag{45}
$$

For TEM calculations, the value for n is arbitrarily selected as 4, since for greater values of i the contribution of these area sources at the receptor is small. Furthermore, in the TEM-8 the contribution of each area source is determined for 4 squares downwind rather than determining the total contribution of all sources at each affected receptor. Thus from equation (45) the pollutant concentration at the receptor in the center of a given source is

$$\chi = \sqrt{\frac{2}{\pi}}\ \frac{Q\left(\frac{\Delta x}{2}\right)^{1-b(S)}}{Ua(S)[1-b(S)]} \qquad (46)$$

Equation (46) is listed as equation (23) in section 2.2.2. Also from equation (45) the contribution of a given source Q, k squares downwind of the source is:

$$\chi = \sqrt{\frac{2}{\pi}}\ \frac{\left(\frac{\Delta x}{2}\right)^{1-b(S)}}{Ua(S)[1-b(S)]}\ Q\left[(2k+1)^{1-b(S)} - (2k-1)^{1-b(S)}\right] \qquad (47)$$

where in equation (45) k=1,2,3 or 4; $Q_k = Q$; and $Q_i = 0$ for $i \neq k$. Equation (47) is listed as equation (24) in section 2.2.2.

APPENDIX E

Derivation of Flare Input as a Point Source

As indicated in Section 2.3.1, flares can be modeled as a point source with the TEM-8 by using a set of arbitrary dummy variables for stack temperature, stack velocity, and stack diameter. The nature of a flare prevents accurate estimates of these parameters for model inputs.

The strategy is to find dummy variables that will predict a reasonable plume rise. It is desirable to avoid excessive stack tip downwash caused by artificially large stack diameters and/or by low artificial stack velocities. Also it is desirable to minimize the variation in F, the buoyancy flux component, when a variety of ambient temperatures are used.

$$F = \frac{gVD^2}{4} \left(\frac{T-T_A}{T}\right) \tag{48}$$

where:

F is the buoyancy flux
g is the gravitational constant, meters per second squared
V is the stack temperature, meters per second
D is the stack diameter, meters
T is the stack temperature, degrees K
T_A is the ambient temperature, degrees K

Let T = 1000°C and allow T_A to vary from 0°C to 40°C (reasonable extreme ambient temperatures for most sites in Texas). If all other variables in equation (48) remain constant, then there is a 4% difference between F values calculated for T_A = 0°C and T_A = 40°C.

Briggs [12] gives an alternate parameterization of F as:

$$F = 3.7 \times 10^{-5} q_n \tag{49}$$

where q_n is the heat release in cal/sec.

Equating equations (48) and (49)

$$3.7 \times 10^{-5} q_n = \frac{gVD^2}{4} \left(\frac{T-T_A}{T}\right)$$

Arbitrarily set V = 20 m/s, T = 1000°C, and T_A = 35°C.

Then,

$$3.7 \times 10^{-5} q_n = \frac{(9.8)(20)D^2}{4} \ \frac{1273 - 308}{1273}$$

Thus

$$q_n = 1003906D^2$$

and $$D = \sqrt{q_n} \times 10^{-3}$$

APPENDIX F

Distance to the Point of Maximum Concentration

The distance to the point of maximum concentration predicted by equation (29) can be determined by using the power law approximations for σ_y and σ_z in equation (29), differentiating with respect to x, equating to zero and solving for x. Since the maximum concentration will occur along the plume center line, y = 0 and equation (29) becomes

$$\chi = \frac{Q}{\pi U \sigma_z \sigma_y} \quad \exp\left[- \frac{H^2}{2\sigma_z^{\,2}}\right]$$

$$= \frac{Q}{\pi U a x^b c x^d} \quad \exp\left[- \frac{H^2}{2(ax^b)^2}\right]$$

where a,b,c and d are functions of S, atmospheric stability class, and are defined in Table 2-9.

$$\frac{d\chi}{dx} = \frac{Q}{\pi U a c} \left\{ -(b+d)x^{-(b+d)-1} \quad \exp\left[- \frac{H^2}{2a^2} \; x^{-2b}\right] \quad + \right.$$

$$\left. x^{-(b+d)} \quad \frac{H^2}{2a^2} \quad (2b)x^{-2b-1} \; \exp\left[- \frac{H^2}{2a^2} \, x^{-2b}\right] \right\}$$

$$= \frac{Q}{\pi U a c} \, x^{-(b+d+1)} \; \exp\left[- \frac{H^2}{2a^2} \, x^{-2b}\right] \left\{ -(b+d) + \frac{H^2 b}{a^2} \quad x^{-2b} \right\}$$

Letting $\frac{d\chi}{dx}$ = 0 and solving for x

$$b+d = \frac{bH^2}{a^2} \; x^{-2b} \quad .$$

$$x^{2b} = \frac{bH^2}{a^2(b+d)}$$

$$x = \left[\frac{bH^2}{a^2(b+d)} \right]^{\frac{1}{2b}}$$

APPENDIX G

TEM-8 SAMPLE AREA SOURCE TEST RUN

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```
                              T E X A S   E P I S O D I C   M O D E L                              VERSION 8 (P-G)
        CONTROL PARAMETERS:   AREA SOURCE TEST
-----------------------------------------------------------------------------------------------------------------------
AVERAGING TIME OPTION (NTOPT):

OPTION 1: BASIC AVERAGING TIME OF 10 MINUTES
OPTION 2: RESULTS CONVERTED TO 30 MIN AVERAGING TIME
OPTION 3: RESULTS CONVERTED TO 1 HOUR AVERAGING TIME
OPTION 4: RESULTS CONVERTED TO 3 HOUR AVERAGING TIME
OPTION 5: 24 HOUR AVERAGING TIME: 8 3-HOUR
               SCENARIOS ARE AVERAGED.
OPTION 6: 24 HOUR AVERAGING TIME: 24 1-HOUR
               SCENARIOS ARE AVERAGED.
OPTION 7: 1 TO 24 SCENARIOS WITH THE BASIC AVERAGING
               TIME OF 10 MINUTES ARE AVERAGED TO GIVE
               1 SET OF PREDICTED CONCENTRATIONS.
OPTION 8: 1 TO 24 SCENARIOS WITH 1 HOUR AVERAGING
               TIMES ARE AVERAGED TO GIVE 1 SET OF
               PREDICTED CONCENTRATIONS.

OPTION 3 HAS BEEN SELECTED.
--------------------------------------------------

 1 SCENARIO(S) ARE INCLUDED IN THIS RUN.
                  MAXIMUM IS NSCEN = 24.

POLLUTANT(S)  1  ON POLLUTANT SOURCE CARDS
ARE MODELED IN THIS RUN.

DT/DZ (E STABILITY) =  0.0200
DT/DZ (F STABILITY) =  0.0350

PUNCH INTERVAL =   1.

THE STACK-TIP DOWNWASH ALGORITHM IS IN EFFECT.


WIND DIRECTION OPTIONS (NWDOPT):

OPTION 0: WIND DIRECTION IN DEGREES
                  SPECIFIED FOR EACH SCENARIO
OPTION 1: WIND SECTOR NUMBER SPECIFIED
                  FOR EACH SCENARIO

OPTIONS 2-7 ARE SIMILAR. FOR EACH, THE
WIND DIRECTION IS SPECIFIED IN DEGREES,
AND 4 ACTUAL SCENARIOS ARE GENERATED FOR
EACH SCENARIO CARD. FOR EACH OF THESE 4
SCENARIOS, ALL WEATHER PARAMETERS REMAIN
THE SAME EXCEPT THE WIND DIRECTION. THE
WIND DIRECTION FOR THE FIRST SCENARIO IS
THE ONE ENTERED ON THE CARD; FOR EACH
OF THE SUCCEEDING SCENARIOS, THE WIND
DIRECTION IS INCREASED BY 90,45,30,15,
10, OR 5 DEGREES, DEPENDING ON THE
OPTION USED:

OPTION 2: 90 DEGREE W.D. INCREMENT
OPTION 3: 45 DEGREE W.D. INCREMENT
OPTION 4: 30 DEGREE W.D. INCREMENT
OPTION 5: 15 DEGREE W.D. INCREMENT
OPTION 6: 10 DEGREE W.D. INCREMENT
OPTION 7:  5 DEGREE W.D. INCREMENT


WIND SPEED OPTIONS (NWSOPT):

OPTION 0: WIND SPEED IN METERS PER
               SECOND SPECIFIED FOR
               EACH SCENARIO
 OPTION 1: WIND SPEED CLASS NUMBER
               SPECIFIED FOR
               EACH SCENARIO

 OPTION 1 HAS BEEN SELECTED.
 ---------------------------------

 INPUT UNITS OPTION (NSRCOP):

 OPTION 1: GRID PARAMETERS AND
              SOURCE LOCATIONS
              IN KM. SOURCE
              PARAMETERS IN M, M/S,
              GM/S, DEGREES CELSIUS.
 OPTION 2: GRID PARAMETERS AND
              SOURCE LOCATIONS
              IN FT. SOURCE
              PARAMETERS IN FT,
              FT/S, LB/HR, DEGREES
              FAHRENHEIT.
 OPTION 3: MIXED UNITS - GRID
              PARAMETERS AND SOURCE
              LOCATIONS IN KM,
              SOURCE PARAMETERS IN
              FT, FT/S, LB/HR,
              DEGREES FAHRENHEIT.


   (ALL AREA SOURCE INPUT
         IS IN METRIC UNITS)

                                                OPTION 1 HAS BEEN SELECTED.          CPTION 1 HAS BEEN SELECTED.
-----------------------------------------------------------------------------------------------------------------------
RECEPTOR GRID CONSISTS OF 25 COLUMNS AND 25 ROWS OF SPACING = 0.040 KM.  SOUTHWEST CORNER OF GRID =   0.000 KM W.   0.000 KM S.

AREA SOURCE SCALING FACTOR, 1ST POLLUTANT, =    1.0000      AREA SOURCE SCALING FACTOR, 2ND POLLUTANT, =    0.0000

CONCENTRATION CALIBRATION FACTORS:   A(1) =     0.0000,  B(1) =     0.0,       A(2) =     0.0000,  B(2) =     0.0000

POL 1 ID:PA          POL 1 CAL ID:                          / POL 2 ID:                   POL 2 CAL ID:
-----------------------------------------------------------------------------------------------------------------------
OUTPUT WILL BE PRESENTED IN THE FOLLOWING FORM(S):
                                            MAP OF CONCENTRATIONS IN GRID, UNCALIBRATED ONLY
                                            MAXIMUM PREDICTED CONCENTRATION(S) FOR EACH SCENARIO
```

```
                                         T E X A S   E P I S O D I C   M O D E L
            SCENARIO PARAMETERS:   AREA SOURCE TEST                                                                     VERSION 6 (P-G)
---------------------------------------------------------------------------------------------------------------------------------------

                 WIND DIRECTIONS                                     WIND SPEED CLASSES                STABILITY CLASSES

SECTOR          DIRECTION     SECTOR          DIRECTION        CLASS    SPEED    SPEED CLASS          CLASS
NUMBER          (DEGREES)     NUMBER          (DEGREES)        INDEX    (M/S)    INTERVAL(KT)         INDEX  CLASS
   1     N         0.0           9     S        180.0
   2     NNE      22.5          10     SSW      202.5            1       1.50        0- 3               1      A
   3     NE       45.0          11     SW       225.0            2       2.46        4- 6               2      B
   4     ENE      67.5          12     WSW      247.5            3       4.47        7-10               3      C
   5     E        90.0          13     W        270.0            4       6.93       11-16               4      D (DAY)
   6     ESE     112.5          14     WNW      292.5            5       9.61       17-21               5      D (NIGHT)
   7     SE      135.0          15     NW       315.0            6       1[illegible]     OVER 21             6      E
   8     SSE     157.5          16     NNW      337.5                                                   7      F
---------------------------------------------------------------------------------------------------------------------------------------
SCENARIO  STABILITY     WIND SPEED  WIND SPEED   WIND      WIND        AMBIENT     HALF-LIFE   HALF-LIFE      INVERSION        MIXING
 NUMBER     CLASS         CLASS    (METERS/SEC) SECTOR  DIRECTION   TEMPERATURE    POL. 1      POL. 2   PENETRATION FACTOR   HEIGHT

   1         DD             3         ******       9    ****** DEG    32.20 C    999.99 HR   999.99 HR         2.000         9999.9 M
```

```
T.E.M. VERSION 8 - AREA SOURCE LIST -  AREA SOURCE TEST

NUMBER    X (KM)    Y (KM)     AREA SIZE (KM)    E1 (G/S)    E2 (G/S)

   1       0.46      0.02          0.0400          1.0000      0.0000

THE SUM OF THE AREA SOURCE EMISSION RATES IN THIS RUN IS    1.0000(G/S) FOR POLLUTANT 1 AND    0.0000(G/S) FOR POLLUTANT 2.
```

```
T.E.M. VERSION 8 - POINT SOURCE LIST -  AREA SOURCE TEST

NUMBER    X (KM)     Y (KM)     E1 (G/S)    E2 (G/S)     HT (M)     DIAM (M)     VEL (M/S)     TEMP (K)    IDENTIFICATION

   1       0.24       0.04       1.0000      0.0000       1.01        1.000         0.030       273.150
   2       0.68       0.04       1.0000      0.0000       0.01       10.000         0.010       305.550

THE SUM OF THE POINT SOURCE EMISSION RATES IN THIS RUN IS      2.00(G/S) FOR POLLUTANT 1 AND      0.00(G/S) FOR POLLUTANT 2.
```

```
T.E.M. VERSION 8 -  AREA SOURCE TEST

SCENARIO  1  POINT SOURCE PLUME RISE CALCULATIONS.  MIXING HEIGHT = 9999.90 M. IF MAX. HT. > 19999.8 M. SOURCE IS NEGLECTED.

NUMBER   X (KM)   Y (KM)   E1 (G/S)  E2 (G/S)   HT (M)  DIAM (M)  VEL (M/S)  TEMP (K)  DOMINANT INFLUENCE  MAX EFF SOURCE HT (M)

   1       0.24     0.04      1.00      0.00      1.01    1.000      0.000    273.15      BUOYANCY DOWNWASHED      1.0
   2       0.68     0.04      1.00      0.00      0.01   10.000      0.010    305.55      MOMENTUM DOWNWASHED      0.0
```

```
SECTION 1 OF 1, SCENARIO  1   AREA SOURCE TEST
STABILITY=0D, WIND SPD= 4.47 M/S, WIND DIR=180.00 DEG, MIXING HT= 9999.9 M, AVERAGING TIME=   1 HR.        T.E.M. VERSION 8
UNCALIBRATED CONCENTRATIONS - MICROGRAMS PER CUBIC METER                                        POLLUTANT 1, PA

             0.00    0.08    0.16    0.24    0.32    0.40    0.48    0.56    0.64    0.72    0.80    0.88    0.96
    0.96      2   4   8  13  18  22  23  22  18  13   9   6   6   9  13  18  22  23  22  18  13   8   4   2   1        0.96
    0.92      2   4   8  13  19  23  25  23  19  13   8   6   6   8  13  19  23  25  23  19  13   8   4   2   1        0.92
    0.88      1   4   7  13  20  25  27  25  20  13   8   5   5   8  13  20  25  27  25  20  13   7   4   1   1        0.88
    0.84      1   3   7  13  21  27  29  27  21  13   7   4   4   7  13  21  27  29  27  21  13   7   3   1   0        0.84
    0.80      1   3   7  13  22  29  32  29  22  13   7   4   4   7  13  22  29  32  29  22  13   7   3   1   0        0.80
    0.76      1   2   6  13  23  31  35  31  23  13   6   3   3   6  13  23  31  35  31  23  13   6   2   1   0        0.76
    0.72      0   2   5  13  24  34  38  34  24  13   6   2   2   6  13  24  34  38  34  24  13   6   2   0   0        0.72
    0.68      0   2   5  13  25  37  42  37  25  13   5   2   2   5  13  25  37  42  37  25  13   5   2   0   0        0.68
    0.64      0   1   4  12  25  40  46  40  25  12   4   1   1   4  12  26  40  46  40  26  12   4   1   0   0        0.64
    0.60      0   0   3  11  26  44  52  44  26  11   3   0   0   3  11  26  44  52  44  26  11   3   0   0   0        0.60
    0.56      0   0   3  10  27  48  58  48  27  10   3   0   0   3  10  27  48  58  48  27  10   3   0   0   0        0.56
    0.52      0   0   2   9  27  53  67  53  27   9   2   0   0   2   9  27  53  67  53  27   9   2   0   0   0        0.52
    0.48      0   0   0   7  27  60  78  60  27   7   0   0   0   0   7  27  60  78  60  27   7   0   0   0   0        0.48
    0.44      0   0   0   5  26  67  92  67  26   5   0   0   0   0   5  26  68  92  68  26   5   0   0   0   0        0.44
    0.40      0   0   0   4  24  76 111  76  24   4   0   0   0   0   4  24  76 112  76  24   4   0   0   0   0        0.40
    0.36      0   0   0   0  21  86 137  86  21   0   0   0   0   0   0  21  86 138  86  21   0   0   0   0   0        0.36
    0.32      0   0   0   0  16  95 174  95  16   0   0   0   0   0   0  16  96 175  95  16   0   0   0   0   0        0.32
    0.28      0   0   0   0   9 103 228 103   9   0   0   0   0   0   0   9 103 230 103   9   0   0   0   0   0        0.28
    0.24      0   0   0   0   0 103 315 103   0   0   0   0   0   0   0   0 104 318 104   0   0   0   0   0   0        0.24
    0.20      0   0   0   0   0  87 468  87   0   0   0   0 351   0   0   0  88 473  88   0   0   0   0   0   0        0.20
    0.16      0   0   0   0   0  45 775  45   0   0   0   0 443   0   0   0  46 789  46   0   0   0   0   0   0        0.16
    0.12      0   0   0   0   0   01568   0   0   0   0   0 619   0   0   0   01625   0   0   0   0   0   0   0        0.12
    0.08      0   0   0   0   0   04962   0   0   0   0   01134   0   0   0   05582   0   0   0   0   0   0   0        0.08
    0.04      0   0   0   0   0   0   0   0   0   0   0   04616   0   0   0   0   0   0   0   0   0   0   0   0        0.04
    0.00      0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0        0.00
             0.00    0.08    0.16    0.24    0.32    0.40    0.48    0.56    0.64    0.72    0.80    0.88    0.96
```

```
                TEXAS EPISODIC MODEL, VERSION 8:  HIGHEST PREDICTED CONCENTRATIONS OF EACH POLLUTANT FOR EACH SCENARIO

                      AREA SOURCE TEST
------------------------------------------------------------------------------------------------------------------------
UNCALIBRATED CONCENTRATIONS IN MICROGRAMS PER CUBIC METER  -  CALIBRATION, POLLUTANT 1:
                                                              CALIBRATION, POLLUTANT 2:

                                 RECEPTOR COORDINATES    POLLUTANT 1 (PA           )   RECEPTOR COORDINATES    POLLUTANT 2 (              )
SCENARIO   WIND DIRECTION                               UNCALIBRATED   CALIBRATED                              UNCALIBRATED    CALIBRATED
 NUMBER     SUB-SCENARIO        X (KM)     Y (KM)     CONCENTRATION  CONCENTRATION     X (KM)     Y(KM)     CONCENTRATION  CONCENTRATION

   1             1               0.680      0.380      5581.5992          0.0000
```

APPENDIX H

TEM-8 SAMPLE RUN

Reproduced from
best available copy.

Data Coding Form

TEXAS EPISODIC MODEL, version 8

Page 1: Control Parameters

Subject of run: ______ Run requested by: ______ Date: ______

PROBLEM DESCRIPTION

① TEN SAMPLE RUN VERSION 8

SAMPLING TIME OPTIONS
A=1: 10 minutes
A=2: 30 minutes
A=3: 1 hour
A=4: 3 hours
A=5: 24 hours
(8 3-hour scenarios)
A=6: 24 hours
(24 1-hour scenarios)
A=7: variable. 1 to 24
10-minute scenarios
are averaged together
A=8: variable. 1 to 24
1-hour scenarios are
averaged together.

WIND DIRECTION OPTIONS
B=0: specify in degrees
B=1: specify sector number
B=2: 4 scenarios 90° apart
B=3: 4 scenarios 45° apart
B=4: 4 scenarios 30° apart
B=5: 4 scenarios 15° apart
B=6: 4 scenarios 10° apart
B=7: 4 scenarios 5° apart

WIND SPEED OPTIONS
C=0: specify in
meters/second
C=1: specify wind
speed class

D= NUMBER OF SCENARIOS

POLLUTANTS-USED INDEX
E=1: 1st pollutant only
E=2: 2nd pollutant only
E=3: 1st & 2nd pollutants

CONCENTRATION LIST OPTIONS
F=0: no list printed
F=1: list printed

CONCENTRATION MAP OPTIONS
G=0: no maps printed
G=1: maps of uncalibrated & calibrated concentrations
G=2: maps of uncalibrated concentrations only
G=3: maps of calibrated concentrations only

PUNCHED CARD OUTPUT OPTIONS
H=0: no cards punched
H=1: cards punched

CULPABILITY LIST OPTIONS
I=0: no culpability list
I=1: culpability list printed

MAXIMUM CONCENTRATION OPTIONS
J=0: maxima not printed
J=1: maximum concentrations for each scenario printed

STACK-TIP DOWNWASH OPTION
K=0: Downwash is checked.
K=1: Downwash is not checked

L= GRID PUNCH INTERVAL
Every Lth column & row of receptor grid is punched

INPUT UNIT OPTIONS
M=1: grid and source parameters in metric units
M=2: grid and source parameters in English units
M=3: grid parameters in km, source parameters in English units.

PT SOURCE LIST OPTION
N=0: Only the initial source list is printed.
N=1: A source list for each scenario is printed

PT SOURCE INPUT OPTION
O=1: Pt source data is read from cards.
O=2: Data read from a disk file.

(right-justify)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
②	4	1	1	1	3	0	2	0	0	1	0	0	1	1	1

	WEST GRID BOUNDARY	SOUTH GRID BOUNDARY	NUMBER OF N-S COLUMNS IN RECEPTOR GRID (MAX=50)	NUMBER OF E-W ROWS IN RECEPTOR GRID (MAX=50)	SPACING BETWEEN ROWS AND COLUMNS	dθ/dz (E stability)	dθ/dz (F stability)
③	300.00	3000.00	25	25	1.0		

(km if M=1 or 3, ft if M=2)
(right-justify)
(km if M=1 or 3, ft if M=2)
(Input of dθ/dz's is optional)
Leave SPACING blank for automatic grid option.

C A L I B R A T I O N F A C T O R S

	AREA SOURCE SCALING FACTOR, POLLUTANT 1	AREA SOURCE SCALING FACTOR, POLLUTANT 2	intercept, pol. 1	intercept, pol. 2	slope, pol. 1	slope, pol. 2
④					10.0	10.0

Include decimal points except on card ②, and COLUMNS and ROWS on card ③

	Pol. 1 identification	Pol. 1 calibration description	Pol. 2 identification	Pol. 2 calibration description
⑤	PARTICULATE	MULT. BY TEN	SO2	MULT. BY TEN

TEXAS EPISODIC MODEL

Left-justify and include decimal point unless stated otherwise.

Texas Air Control Board

DATA CODING FORM

PAGE 2: Scenario Parameters

Subject of run: ______________________

Run requested by: ______________________

Date: ______________________

S C E N A R I O C A R D S (one for each scenario; maximum of 24)

STABILITY CLASS

1:	A	very unstable.
2:	B	moderately unstable.
3:	C	slightly unstable.
4:	DD	neutral (day).
5:	DN	neutral (night).
6:	E	slightly stable.
7:	F	stable (rural only).

WIND SPEED CLASS

1:	1.50 m/s,	0- 3 knots
2:	2.46	4- 6
3:	4.47	7-10
4:	6.93	11-16
5:	9.61	17-21
6:	12.52	over 21

WIND SECTOR

1:	N,	0°	9:	S,	180°
2:	NNE,	22.5	10:	SSW,	202.5
3:	NE,	45.	11:	SW,	225.
4:	ENE,	67.5	12:	WSW,	247.5
5:	E,	90.	13:	W,	270.
6:	ESE,	112.5	14:	WNW,	292.5
7:	SE,	135.	15:	NW,	315.
8:	SSE,	157.5	16:	NNW,	337.5

*** If C=0 on card 2, enter wind speed (m/s), not wind speed class.
If C=1, enter wind speed class, not wind speed.

*** If B=0 on card 2, enter wind direction, not sector.
If B=1, enter wind sector, not direction.

STAB-ILITY CLASS	WIND SPEED CLASS	WIND SECTOR	WIND SPEED (m/s)	WIND DIRECTION (degrees)	AMBIENT TEMPERATURE (degrees Celsius)	HALF-LIFE OF POLLUTANT 1 (hr)	HALF-LIFE OF POLLUTANT 2 (hr)	INVERSION PENETRATION FACTOR	MIXING HEIGHT (m)
3	6	9 10	14 15 16 17 18 19 20	24 25 26 27 28 29 30	34 35 36 37 38 39 40	44 45 46 47 48 49 50	54 55 56 57 58 59 60	64 65 66 67 68 69 70	74 75 76 77 78 79 80
4	4	7			32.22		6.0		900.0

(right-justify)

AREA SOURCE AND POINT SOURCE DATA CODING FORM FOR: TEXAS EPISODIC MODEL (TEM-8) metric input option Texas Air Control Board

*** INCLUDE DECIMAL POINT FOR ALL PARAMETERS ***

SOURCE COORDINATES		(AREA SOURCES ONLY)	POLLUTANT EMISSION RATES		(INPUT FOR POINT SOURCES ONLY)						
X (km)	Y (km)	source size (m)	pollutant 1 (gm/s)	pollutant 2 (gm/s)	HEIGHT (m)	DIAMETER (m)	VELOCITY (m/s)	TEMPERATURE (degrees C)		IDENTIFICATION	
310.00	3000.00		20.0	20.0	50.0	1.0	15.0	200.0		STACK 1	
320.00	3002.00		10.0	40.0	25.0	0.75	20.0	150.0		STACK 2	

```
                                        T E X A S   E P I S O D I C   M O D E L                                     VERSION 8 (P-G)

           CONTROL PARAMETERS:  TEM SAMPLE RUN       VERSION 8
-------------------------------------------------------------------------------------------------------------------------------
AVERAGING TIME OPTION (NTOPT):                       WIND DIRECTION OPTIONS (NWDOPT):          WIND SPEED OPTIONS (NWSOPT):

OPTION 1: BASIC AVERAGING TIME OF 10 MINUTES         OPTION 0: WIND DIRECTION IN DEGREES     OPTION 0: WIND SPEED IN METERS PER
OPTION 2: RESULTS CONVERTED TO 30 MIN AVERAGING TIME           SPECIFIED FOR EACH SCENARIO             SECOND SPECIFIED FOR
OPTION 3: RESULTS CONVERTED TO 1 HOUR AVERAGING TIME OPTION 1: WIND SECTOR NUMBER SPECIFIED            EACH SCENARIO
OPTION 4: RESULTS CONVERTED TO 3 HOUR AVERAGING TIME        '  FOR EACH SCENARIO                  OPTION 1: WIND SPEED CLASS NUMBER
OPTION 5: 24 HOUR AVERAGING TIME: 8 3-HOUR                                                              SPECIFIED FOR
          SCENARIOS ARE AVERAGED.                    OPTIONS 2-7 ARE SIMILAR. FOR EACH, THE             EACH SCENARIO
OPTION 6: 24 HOUR AVERAGING TIME: 24 1-HOUR          WIND DIRECTION IS SPECIFIED IN DEGREES,
          SCENARIOS ARE AVERAGED.                    AND 4 ACTUAL SCENARIOS ARE GENERATED FOR  OPTION 1 HAS BEEN SELECTED.
OPTION 7: 1 TO 24 SCENARIOS WITH THE BASIC AVERAGING EACH SCENARIO CARD. FOR EACH OF THESE 4   ---------------------------------
          TIME OF 10 MINUTES ARE AVERAGED TO GIVE    SCENARIOS, ALL WEATHER PARAMETERS REMAIN
          1 SET OF PREDICTED CONCENTRATIONS.         THE SAME EXCEPT THE WIND DIRECTION. THE   INPUT UNITS OPTION (NSRCOP):
OPTION 8: 1 TO 24 SCENARIOS WITH 1 HOUR AVERAGING    WIND DIRECTION FOR THE FIRST SCENARIO IS
          TIMES ARE AVERAGED TO GIVE 1 SET OF        THE ONE ENTERED ON THE CARD; FOR EACH     OPTION 1: GRID PARAMETERS AND
          PREDICTED CONCENTRATIONS.                  OF THE SUCCEEDING SCENARIOS, THE WIND              SOURCE LOCATIONS
                                                     DIRECTION IS INCREASED BY 90,45,30,15,             IN KM, SOURCE
                                                     10, OR 5 DEGREES, DEPENDING ON THE                 PARAMETERS IN M, M/S,
OPTION 4 HAS BEEN SELECTED.                          OPTION USED:                                       GM/S, DEGREES CELSIUS.
---------------------------------------------------                                            OPTION 2: GRID PARAMETERS AND
                                                     OPTION 2: 90 DEGREE W.D. INCREMENT                 SOURCE LOCATIONS
 1 SCENARIO(S) ARE INCLUDED IN THIS RUN.             OPTION 3: 45 DEGREE W.D. INCREMENT                 IN FT, SOURCE
                 MAXIMUM IS NSCEN = 24.              OPTION 4: 30 DEGREE W.D. INCREMENT                 PARAMETERS IN FT,
                                                     OPTION 5: 15 DEGREE W.D. INCREMENT                 FT/S, LB/HR, DEGREES
POLLUTANT(S) 1&2 ON POLLUTANT SOURCE CARDS           OPTION 6: 10 DEGREE W.D. INCREMENT                 FAHRENHEIT.
ARE MODELED IN THIS RUN.                             OPTION 7:  5 DEGREE W.D. INCREMENT        OPTION 3: MIXED UNITS - GRID
                                                                                                        PARAMETERS AND SOURCE
DT/DZ (E STABILITY) =  0.0200                                                                           LOCATIONS IN KM,
DT/DZ (F STABILITY) =  0.0350                                                                           SOURCE PARAMETERS IN
                                                                                                        FT, FT/S, LB/HR,
PUNCH INTERVAL =   1.                                                                                   DEGREES FAHRENHEIT.

THE STACK-TIP DOWNWASH ALGORITHM IS IN EFFECT.
                                                                                               (ALL AREA SOURCE INPUT
                                                                                                     IS IN METRIC UNITS)

                                                        OPTION 1 HAS BEEN SELECTED.             OPTION 1 HAS BEEN SELECTED.
-------------------------------------------------------------------------------------------------------------------------------
RECEPTOR GRID CONSISTS OF 25 COLUMNS AND 25 ROWS OF SPACING = 1.000 KM.  SOUTHWEST CORNER OF GRID = 300.000 KM W, 3000.000 KM S.

AREA SOURCE SCALING FACTOR, 1ST POLLUTANT, =     0.0000      AREA SOURCE SCALING FACTOR, 2ND POLLUTANT, =     0.0000

CONCENTRATION CALIBRATION FACTORS:   A(1) =      0.0000,  B(1) =     10.0000;    A(2) =      0.0000,  B(2) =     10.0000

POL 1 ID:PARTICULATE   POL 1 CAL ID:MULT.BY TEN                       / POL 2 ID:SO2             POL 2 CAL ID:MULT. BY TEN
-------------------------------------------------------------------------------------------------------------------------------
OUTPUT WILL BE PRESENTED IN THE FOLLOWING FORM(S):
                                                       MAP OF CONCENTRATIONS IN GRID, UNCALIBRATED ONLY
                                                       MAXIMUM PREDICTED CONCENTRATION(S) FOR EACH SCENARIO
```

```
                                   T E X A S   E P I S O D I C   M O D E L                                          VERSION 8 (P-G)
          SCENARIO PARAMETERS:  TEM SAMPLE RUN        VERSION 8
------------------------------------------------------------------------------------------------------------------------------

                WIND DIRECTIONS                                       WIND SPEED CLASSES                 STABILITY CLASSES

SECTOR          DIRECTION     SECTOR             DIRECTION        CLASS    SPEED     SPEED CLASS         CLASS
NUMBER          (DEGREES)     NUMBER             (DEGREES)        INDEX    (M/S)     INTERVAL(KT)        INDEX   CLASS
   1     N         0.0           9      S         180.0
   2     NNE      22.5          10      SSW       202.5             1       1.50         0- 3               1      A
   3     NE       45.0          11      SW        225.0             2       2.46         4- 6               2      B
   4     ENE      67.5          12      WSW       247.5             3       4.47         7-10               3      C
   5     E        90.0          13      W         270.0             4       6.93        11-16               4      D (DAY)
   6     ESE     112.5          14      WNW       292.5             5       9.61        17-21               5      D (NIGHT)
   7     SE      135.0          15      NW        315.0             6      12.52      OVER 21               6      E
   8     SSE     157.5          16      NNW       337.5                                                     7      F
------------------------------------------------------------------------------------------------------------------------------

SCENARIO  STABILITY   WIND SPEED  WIND SPEED   WIND      WIND       AMBIENT     HALF-LIFE   HALF-LIFE      INVERSION         MIXING
 NUMBER     CLASS       CLASS    (METERS/SEC) SECTOR  DIRECTION  TEMPERATURE   POL. 1      POL. 2    PENETRATION FACTOR   HEIGHT

   1         DD           4         ******      7     ****** DEG    32.22 C   999.99 HR    6.00 HR          2.000         900.0 M
```

```
T.E.M. VERSION 8 - POINT SOURCE LIST - TEM SAMPLE RUN       VERSION 6

NUMBER    X (KM)     Y (KM)      E1 (G/S)     E2 (G/S)     HT (M)    DIAM (M)    VEL (M/S)    TEMP (K)    IDENTIFICATION

   1      310.00    3000.00      20.0000      80.0000      50.00      1.000       15.000      473.150        STACK 1
   2      320.00    3002.00      10.0000      40.0000      25.00      0.750       20.000      423.150        STACK 2

THE SUM OF THE POINT SOURCE EMISSION RATES IN THIS RUN IS      30.00(G/S) FOR POLLUTANT 1 AND     120.00(G/S) FOR POLLUTANT 2.
```

```
T.E.M. VERSION 8 - TEM SAMPLE RUN        VERSION 8

SCENARIO  1  POINT SOURCE PLUME RISE CALCULATIONS.  MIXING HEIGHT =  900.00 M. IF MAX. HT. >  1800.0 M. SOURCE IS NEGLECTED.

NUMBER    X (KM)    Y (KM)    E1 (G/S)  E2 (G/S)    HT (M)  DIAM (M)   VEL (M/S)  TEMP (K)  DOMINANT INFLUENCE  MAX EFF SOURCE HT (M)

   1      310.00   3000.00     20.00     80.00      50.00     1.500     15.000    473.15        BUOYANCY DOWNWASHED      64.0
   2      320.00   3002.00     10.00     40.00      25.00     0.750     20.000    423.15        BUOYANCY                 36.3
```

```
SECTION 1 OF 1, SCENARIO 1  TEM SAMPLE RUN        VERSION 8
STABILITY=DD, WIND SPD= 6.93 M/S. WIND DIR=135.00 DEG. MIXING HT=  900.0 M, AVERAGING TIME=   3 HR.        T.E.M. VERSION 8
UNCALIBRATED CONCENTRATIONS - MICROGRAMS PER CUBIC METER                                                  POLLUTANT 1, PARTICULATE

              300.00   302.00   304.00   306.00   308.00   310.00   312.00   314.00   316.00   318.00   320.00   322.00   324.00
   3024.00      0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   3023.00      0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3024.00
   3022.00      0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3023.00
   3021.00      0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3022.00
   3020.00      0  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3021.00
   3019.00      0  0  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3020.00
   3018.00      0  0  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3019.00
   3017.00      0  0  0  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3018.00
   3016.00      0  0  0  0  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3017.00
   3015.00      1  0  0  0  1  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3016.00
   3014.00      1  0  0  0  0  1  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0      3015.00
   3013.00      1  1  0  0  0  0  1  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0  0      3014.00
   3012.00      1  1  1  0  0  0  0  1  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0  0      3013.00
   3011.00      2  1  1  1  0  0  0  0  1  1  1  1  1  1  1  0  0  0  0  0  0  0  0  0  0      3012.00
   3010.00      2  2  2  1  0  0  0  0  0  1  1  1  2  2  1  1  0  0  0  0  0  0  0  0  0      3011.00
   3009.00      2  2  2  2  1  0  0  0  0  0  1  1  2  2  2  1  0  0  0  0  0  0  0  0  0      3010.00
   3008.00      2  2  3  3  2  1  0  0  0  0  0  1  1  2  3  2  1  0  0  0  0  0  0  0  0      3009.00
   3007.00      1  2  3  3  3  2  1  0  0  0  0  0  1  1  2  3  3  1  0  0  0  0  0  0  0      3008.00
   3006.00      0  1  2  3  4  3  2  0  0  0  0  0  0  0  1  3  4  3  0  0  0  0  0  0  0      3007.00
   3005.00      0  0  1  2  3  5  4  1  0  0  0  0  0  0  0  1  3  7  4  0  0  0  0  0  0      3006.00
   3004.00      0  0  0  1  2  4  6  5  1  0  0  0  0  0  0  0  0  4 12  2  0  0  0  0  0      3005.00
   3003.00      0  0  0  0  0  1  5  9  4  0  0  0  0  0  0  0  0  0  2 27  0  0  0  0  0      3004.00
   3002.00      0  0  0  0  0  0  1  4 14  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3003.00
   3001.00      0  0  0  0  0  0  0  0  2 17  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3002.00
   3000.00      0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0      3001.00
                                                                                                      3000.00
             300.00   302.00   304.00   306.00   308.00   310.00   312.00   314.00   316.00   318.00   320.00   322.00   324.00
```

```
SECTION 1 OF 1, SCENARIO  1  TEM SAMPLE RUN          VERSION 8
STABILITY=DD, WIND SPD= 6.93 M/S, WIND DIR=135.00 DEG, MIXING HT=  900.0 M, AVERAGING TIME=   3 HR.       POLLUTANT 2, SO2     T.E.M. VERSION 8
UNCALIBRATED CONCENTRATIONS - MICROGRAMS PER CUBIC METER

             300.00  302.00  304.00  306.00  308.00  310.00  312.00  314.00  316.00  318.00  320.00  322.00  324.00
 3024.00       1   1   1   1   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3024.00
 3023.00       2   2   1   1   1   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3023.00
 3022.00       2   2   2   1   1   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3022.00
 3021.00       2   2   2   2   2   1   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3021.00
 3020.00       2   2   2   2   2   2   1   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3020.00
 3019.00       2   2   2   2   2   2   2   1   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3019.00
 3018.00       2   2   2   2   2   2   2   2   1   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3018.00
 3017.00       2   2   2   2   2   3   3   2   2   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3017.00
 3016.00       2   1   2   2   2   3   3   3   3   2   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0      3016.00
 3015.00       2   1   1   2   2   2   3   3   3   3   2   1   1   0   0   0   0   0   0   0   0   0   0   0   0      3015.00
 3014.00       3   2   1   1   2   2   3   3   4   4   3   2   1   1   0   0   0   0   0   0   0   0   0   0   0      3014.00
 3013.00       4   3   2   1   1   2   2   3   4   4   4   3   2   1   1   0   0   0   0   0   0   0   0   0   0      3013.00
 3012.00       5   4   2   1   1   1   1   2   3   4   5   5   4   2   1   0   0   0   0   0   0   0   0   0   0      3012.00
 3011.00       6   5   4   2   1   1   1   1   2   3   5   5   5   4   2   1   0   0   0   0   0   0   0   0   0      3011.00
 3010.00       8   7   6   4   2   1   1   1   1   2   4   5   6   6   4   2   1   0   0   0   0   0   0   0   0      3010.00
 3009.00       7   9   8   7   4   1   0   0   1   1   2   4   6   8 [illegible]  5   2   0   0   0   0   0   0   0   0      3009.00
 3008.00       6   8  10  10   7   3   1   0   0   1   1   2   4   7  11   9   4   1   0   0   0   0   0   0   0      3008.00
 3007.00       4   7  10  12  11   7   2   0   0   0   0   1   2   5   7  13  11   4   0   0   0   0   0   0   0      3007.00
 3006.00       2   4   7  11  15  13   7   1   0   0   0   0   1   2   4  11  18  13   2   0   0   0   0   0   0      3006.00
 3005.00       1   1   3   7  13  19  16   5   0   0   0   0   0   0   1   4  13  27  14   0   0   0   0   0   0      3005.00
 3004.00       0   0   1   2   7  16  25  18   3   0   0   0   0   0   0   0   2  14  48   7   0   0   0   0   0      3004.00
 3003.00       0   0   0   0   1   5  18  36  18   0   0   0   0   0   0   0   0   0   7 108   0   0   0   0   0      3003.00
 3002.00       0   0   0   0   0   0   3  18  55   6   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3002.00
 3001.00       0   0   0   0   0   0   0   0   6  69   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3001.00
 3000.00       0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0      3000.00
             300.00  302.00  304.00  306.00  308.00  310.00  312.00  314.00  316.00  318.00  320.00  322.00  324.00
```

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          TEXAS EPISODIC MODEL, VERSION 8:  HIGHEST PREDICTED CONCENTRATIONS OF EACH POLLUTANT FOR EACH SCENARIO

                TEM SAMPLE RUN       VERSION 8
------------------------------------------------------------------------------------------------------------------------
UNCALIBRATED CONCENTRATIONS IN MICROGRAMS PER CUBIC METER  -  CALIBRATION, POLLUTANT 1: MULT.BY TEN
                                                              CALIBRATION, POLLUTANT 2: MULT. BY TEN


                            RECEPTOR COORDINATES    POLLUTANT 1 (PARTICULATE )    RECEPTOR COORDINATES    POLLUTANT 2 (SO2          )
SCENARIO  WIND DIRECTION                            UNCALIBRATED    CALIBRATED                            UNCALIBRATED    CALIBRATED
 NUMBER    SUB-SCENARIO        X (KM)    Y (KM)     CONCENTRATION  CONCENTRATION      X (KM)    Y(KM)     CONCENTRATION  CONCENTR ATION

    1           1             319.000  3063.000          27.2694       272.6941      319.000  3063.000        108.2633       1082.6329
```

APPENDIX I

TEM-8 PROGRAM LISTING

```
$SET OWN LINEINFO STACK OPT=1 $ Z    PM26*TEMV8(1).TEM...205544110715
FILE     1 (KIND=PUNCH)

FILE     5 (KIND=READER)

FILE     6 (KIND=PRINTER)

FILE     8 (KIND=DISK)

C
C            ****************************************
C            *
C            * T E X A S   E P I S O D I C   M O D E L *
C            *
C            *      VERSION 8   SIGMA Y REVISED       *
C            *                                         *
C            *                                         *
C            *                                         *
C            *        TEXAS AIR CONTROL BOARD          *
C            *                                         *
C            *             1 9 7 9                     *
C            *                                         *
C            ****************************************
C
C

      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTNU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUOY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
      DIMENSION PRL(2,2)
      DIMENSION DWL(4)
      DIMENSION SECTAN(16),ANGLIM(7)
      DIMENSION ITABLE(5,10),EPSLIM(10),QN(5)
      DIMENSION AAR(6),BAR(6)
      REAL KZ,KZC,KY,KYC
      DATA PRL/4HMOME,4HNTUM,4HBUOY,4HANCY/
      DATA DWL/5H     ,5H     ,5HDOWNW,5HASHED/
      DATA EPSLIM/.12427,.16511,.24504,.35884,.46373,
     1            .55868,.64350,.69482,.71390,.78540/
      DATA ITABLE/0,0,0,0,0, 0,0,0,0,1, 0,0,0,1,1, 0,0,1,1,1, 0,0,1,1,2,
     1            0,1,1,2,2, 0,1,1,2,3, 0,1,2,2,3, 0,1,2,3,3, 0,1,2,3,4/
      DATA IPU,IRD,IWR,IDSK/1,5,6,8/
      DATA INDEX,NAS,NPS/0,0,0/
      DATA SCLAB/2HA ,2HB ,2HC ,2HDD,2HDN,2HE ,2HF /
      DATA TLAB/4H 1/6,4H 1/2,4H   1,4H   3,4H  24,4H  24,4H*1/6,4H* 1 /
      DATA ST/10.,30.,60.,180.,180.,60.,10.,60./
      DATA TBASE/10./
      DATA P/0.1,0.15,0.2,0.25,0.25,0.3,0.3/
      DATA PSC/0.675,0.55,0.425,0.3,0.3,0.175,0.175/
      DATA DLIM/2.,3.,4.,5.,5.,7.,8.,10.,12.,14.,
     1          17.,20.,23.,27.,31.,36.,41.,47.,53.,60./
      DATA HLIM/10.,20.,30.,50.,70.,100.,150.,200.,300.,450.,700.,
     1 1000.,1400.,2000./
      DATA CWS/1.5,2.46,4.47,6.93,9.61,12.52/
      DATA SECTAN/0.,.39270,.78540,1.17810,1.57080,1.96350,2.35620,
     1 2.74890,3.14159,3.53429,3.92699,4.31969,4.71239,5.10509,
     2 5.49779,5.89049/
      DATA AX/.0383,.1393,.112,.0856,.0818,.1094,.05645,
     1        .0002539,.04936,.1014,.2591,.2527,.2452,.1930,
     2        .0002539,.04936,.1154,.7368,1.297,.9204,1.505/
      DATA BX/1.281,.9467,.9100,.865,.8155,.7657,.805,
     1        2.089,1.114,.926,.6869,.6341,.6358,.6072,
     2        2.089,1.114,.9109,.5642,.4421,.4805,.3662/
      DATA AAR/.4,.33,.22,.15,.06,.06/
      DATA BAR/.91,.86,.80,.75,.71,.71/
C
C  TABLE KZ CONTAINS PRECALCULATED COEFFICIENTS DEPENDENT ON
C    DOWNWIND  DISTANCE, EFFECTIVE SOURCE HEIGHT, AND
C    STABILITY CLASS FOR USE IN THE GAUSSIAN PLUME POINT SOURCE EQUATION
C
C
C  KZ DATA TABLE IS IN THE FOLLOWING FORMAT:
C
C    KZ(DOWNWIND DISTANCE, EFFECTIVE STACK HEIGHT, STABILITY CLASS)
C
C
C **** STABILITY CLASS A ****
C
C
      DATA(KZ(I, 1,1),I=1,20)/     .15934,   .06831,   .03745,   .02350,
     1                             .01606,   .01164,   .00880,   .00552,
     2                             .00377,   .00273,   .00182,   .00130,
     3                             .00097,   .00069,   .00052,   .00038,
     4                             .00029,   .00022,   .00017,   .00013/
      DATA(KZ(I, 2,1),I=1,20)/     .15934,   .06831,   .03745,   .02350,
     1                             .01606,   .01164,   .00880,   .00552,
     2                             .00377,   .00273,   .00182,   .00130,
     3                             .00097,   .00069,   .00052,   .00038,
     4                             .00029,   .00022,   .00017,   .00013/
      DATA(KZ(I, 3,1),I=1,20)/     .15933,   .06831,   .03745,   .02350,
     1                             .01606,   .01164,   .00880,   .00552,
     2                             .00377,   .00273,   .00182,   .00130,
     3                             .00097,   .00069,   .00052,   .00038,
     4                             .00029,   .00022,   .00017,   .00013/
      DATA(KZ(I, 4,1),I=1,20)/     .15929,   .06831,   .03745,   .02350,
     1                             .01606,   .01164,   .00880,   .00552,
     2                             .00377,   .00273,   .00182,   .00130,
     3                             .00097,   .00069,   .00052,   .00038,
     4                             .00029,   .00022,   .00017,   .00013/
      DATA(KZ(I, 5,1),I=1,20)/     .15925,   .06830,   .03745,   .02350,
     1                             .01606,   .01164,   .00880,   .00552,
     2                             .00377,   .00273,   .00182,   .00130,
     3                             .00097,   .00069,   .00052,   .00038,
     4                             .00029,   .00022,   .00017,   .00013/
      DATA(KZ(I, 6,1),I=1,20)/     .15914,   .06829,   .03745,   .02350,
     1                             .01606,   .01164,   .00880,   .00552,
     2                             .00377,   .00273,   .00182,   .00130,
     3                             .00097,   .00069,   .00052,   .00038,
     4                             .00029,   .00022,   .00017,   .00013/
      DATA(KZ(I, 7,1),I=1,20)/     .15890,   .06827,   .03745,   .02350,
     1                             .01606,   .01164,   .00880,   .00552,
     2                             .00377,   .00273,   .00182,   .00130,
     3                             .00097,   .00069,   .00052,   .00038,
     4                            .00029,    .00022,    .00017,    .00013/ 00001280
      DATA(KZ(I, 8,1),I=1,20)/    .15855,    .06825,    .03744,    .02350, 00001290
     1                            .01605,    .01163,    .00880,    .00552, 00001300
     2                            .00377,    .00273,    .00182,    .00130, 00001310
     3                            .00097,    .00069,    .00052,    .00038, 00001320
     4                            .00029,    .00022,    .00017,    .00013/ 00001330
      DATA(KZ(I, 9,1),I=1,20)/    .15756,    .06817,    .03743,    .02349, 00001340
     1                            .01605,    .01163,    .00880,    .00552, 00001350
     2                            .00377,    .00273,    .00182,    .00130, 00001360
     3                            .00097,    .00069,    .00052,    .00038, 00001370
     4                            .00029,    .00022,    .00017,    .00013/ 00001380
      DATA(KZ(I,10,1),I=1,20)/    .15535,    .06799,    .03740,    .02349, 00001390
     1                            .01605,    .01163,    .00880,    .00552, 00001400
     2                            .00377,    .00273,    .00182,    .00130, 00001410
     3                            .00097,    .00069,    .00052,    .00038, 00001420
     4                            .00029,    .00022,    .00017,    .00013/ 00001430
      DATA(KZ(I,11,1),I=1,20)/    .14986,    .06754,    .03733,    .02347, 00001440
     1                            .01605,    .01163,    .00880,    .00552, 00001450
     2                            .00377,    .00273,    .00182,    .00130, 00001460
     3                            .00097,    .00069,    .00052,    .00038, 00001470
     4                            .00029,    .00022,    .00017,    .00013/ 00001480
      DATA(KZ(I,12,1),I=1,20)/    .14058,    .06675,    .03719,    .02343, 00001490
     1                            .01604,    .01163,    .00880,    .00552, 00001500
     2                            .00377,    .00273,    .00182,    .00130, 00001510
     3                            .00097,    .00069,    .00052,    .00038, 00001520
     4                            .00029,    .00022,    .00017,    .00013/ 00001530
      DATA(KZ(I,13,1),I=1,20)/    .12465,    .06530,    .03695,    .02337, 00001540
     1                            .01602,    .01162,    .00880,    .00552, 00001550
     2                            .00377,    .00273,    .00182,    .00130, 00001560
     3                            .00097,    .00069,    .00052,    .00038, 00001570
     4                            .00029,    .00022,    .00017,    .00013/ 00001580
      DATA(KZ(I,14,1),I=1,20)/    .09653,    .05230,    .03643,    .02324, 00001590
     1                            .01597,    .01160,    .00879,    .00552, 00001600
     2                            .00377,    .00273,    .00182,    .00130, 00001610
     3                            .00097,    .00069,    .00052,    .00038, 00001620
     4                            .00029,    .00022,    .00017,    .00013/ 00001630
C                                                                          00001640
C   **** STABILITY CLASS B ****                                            00001650
C                                                                          00001660
      DATA(KZ(I, 1,2),I=1,20)/   1.35436,    .86259,    .62618,    .48840, 00001670
     1                            .39364,    .33575,    .28934,    .22566, 00001680
     2                            .18419,    .15513,    .12495,    .10426, 00001690
     3                            .08923,    .07463,    .06399,    .05417, 00001700
     4                            .04686,    .04025,    .03521,    .03066/ 00001710
      DATA(KZ(I, 2,2),I=1,20)/   1.35068,    .86164,    .62581,    .48822, 00001720
     1                            .39855,    .33569,    .28931,    .22565, 00001730
     2                            .18418,    .15512,    .12495,    .10426, 00001740
     3                            .08923,    .07463,    .06399,    .05417, 00001750
     4                            .04686,    .04025,    .03521,    .03066/ 00001760
      DATA(KZ(I, 3,2),I=1,20)/   1.34457,    .86005,    .62521,    .48794, 00001770
     1                            .39839,    .33560,    .28925,    .22562, 00001780
     2                            .18416,    .15511,    .12495,    .10426, 00001790
     3                            .08923,    .07463,    .06399,    .05417, 00001800
     4                            .04686,    .04025,    .03521,    .03066/ 00001810
      DATA(KZ(I, 4,2),I=1,20)/   1.32520,    .85501,    .62327,    .48702, 00001820
     1                            .39789,    .33530,    .28906,    .22553, 00001830
     2                            .18411,    .15508,    .12493,    .10425, 00001840
     3                            .08922,    .07463,    .06398,    .05417, 00001850
     4                            .04686,    .04025,    .03521,    .03066/ 00001860
      DATA(KZ(I, 5,2),I=1,20)/   1.29667,    .84751,    .62038,    .48564, 00001870
     1                            .39714,    .33485,    .28877,    .22539, 00001880
     2                            .18404,    .15504,    .12491,    .10423, 00001890
     3                            .08921,    .07462,    .06398,    .05417, 00001900
     4                            .04685,    .04025,    .03521,    .03066/ 00001910
```

```
      DATA(KZ(I, 6,2),I=1,20)/    1.23807,   .83177,    .61429,    .48274, 00001920
     1                             .39556,   .33390,    .28816,    .22510, 00001930
     2                             .18398,   .15494,    .12486,    .10421, 00001940
     3                             .08919,   .07461,    .06398,    .05416, 00001950
     4                             .04686,   .04025,    .03521,    .03066/ 00001960
      DATA(KZ(I, 7,2),I=1,20)/    1.10539,   .79443,    .59961,    .47568, 00001970
     1                             .39170,   .33159,    .28668,    .22440, 00001980
     2                             .18350,   .15471,    .12474,    .10414, 00001990
     3                             .08915,   .07459,    .06396,    .05415, 00002000
     4                             .04685,   .04024,    .03520,    .03066/ 00002010
      DATA(KZ(I, 8,2),I=1,20)/     .94318,   .74495,    .57963,    .46598, 00002020
     1                             .38636,   .32838,    .28461,    .22341, 00002030
     2                             .18296,   .15439,    .12457,    .10404, 00002040
     3                             .08909,   .07455,    .06394,    .05414, 00002050
     4                             .04684,   .04024,    .03520,    .03066/ 00002060
      DATA(KZ(I, 9,2),I=1,20)/     .59935,   .61993,    .52616,    .43934, 00002070
     1                             .37150,   .31937,    .27879,    .22062, 00002080
     2                             .18144,   .15343,    .12409,    .10376, 00002090
     3                             .08891,   .07445,    .06387,    .05410, 00002100
     4                             .04682,   .04022,    .03519,    .03065/ 00002110
      DATA(KZ(I,10,2),I=1,20)/     .21608,   .41003,    .42320,    .38484, 00002120
     1                             .34012,   .29999,    .26613,    .21447, 00002130
     2                             .17305,   .15144,    .12302,    .10314, 00002140
     3                             .08852,   .07422,    .06373,    .05401, 00002150
     4                             .04676,   .04018,    .03516,    .03063/ 00002160
      DATA(KZ(I,11,2),I=1,20)/     .01594,   .14257,    .24258,    .27433, 00002170
     1                             .27146,   .25565,    .23632,    .19952, 00002180
     2                             .16968,   .14636,    .12033,    .10156, 00002190
     3                             .08753,   .07364,    .06336,    .05379, 00002200
     4                             .04662,   .04009,    .03510,    .03059/ 00002210
      DATA(KZ(I,12,2),I=1,20)/     .00016,   .02189,    .09039,    .15049, 00002220
     1                             .18196,   .19250,    .19142,    .17552, 00002230
     2                             .15580,   .13776,    .11569,    .09882, 00002240
     3                             .08579,   .07261,    .06271,    .05339, 00002250
     4                             .04636,   .03993,    .03499,    .03052/ 00002260
      DATA(KZ(I,13,2),I=1,20)/     .00000,   .00064,    .01410,    .04860, 00002270
     1                             .08570,   .11284,    .12874,    .13790, 00002280
     2                             .13267,   .12291,    .10744,    .09386, 00002290
     3                             .08262,   .07072,    .06150,    .05265, 00002300
     4                             .04588,   .03962,    .03479,    .03039/ 00002310
      DATA(KZ(I,14,2),I=1,20)/     .00000,   .00000,    .00027,    .00440, 00002320
     1                             .01730,   .03627,    .05542,    .08258, 00002330
     2                             .09428,   .09647,    .09181,    .08413, 00002340
     3                             .07625,   .06686,    .05902,    .05112, 00002350
     4                             .04488,   .03898,    .03436,    .03010/ 00002360
C                                                                         00002370
C  **** STABILITY CLASS C ****                                            00002380
C                                                                         00002390
      DATA(KZ(I, 1,3),I=1,20)/    2.74430,  1.88899,   1.44829,   1.17833, 00002400
     1                             .99750,   .86693,    .76770,    .62656, 00002410
     2                             .53071,   .46120,    .38645,    .33328, 00002420
     3                             .29345,   .25357,    .22359,    .19512, 00002430
     4                             .17332,   .15305,    .13718,    .12252/ 00002440
      DATA(KZ(I, 2,3),I=1,20)/    2.71365,  1.87901,   1.44379,   1.17591, 00002450
     1                             .99603,   .86596,    .76703,    .62619, 00002460
     2                             .53049,   .46106,    .38637,    .33323, 00002470
     3                             .29341,   .25355,    .22357,    .19511, 00002480
     4                             .17331,   .15304,    .13718,    .12252/ 00002490
      DATA(KZ(I, 3,3),I=1,20)/    2.66332,  1.86248,   1.43632,   1.17188, 00002500
     1                             .99359,   .86436,    .76592,    .62559, 00002510
     2                             .53012,   .46081,    .38622,    .33314, 00002520
     3                             .29335,   .25351,    .22355,    .19509, 00002530
     4                             .17330,   .15303,    .13717,    .12252/ 00002540
      DATA(KZ(I, 4,3),I=1,20)/    2.50844,  1.81055,   1.41268,   1.15909, 00002550
     1                           .98580,   .85924,   .76236,   .62365, 00002560
     2                           .52894,   .46004,   .38577,   .33284, 00002570
     3                           .29315,   .25338,   .22346,   .19503, 00002580
     4                           .17326,   .15300,   .13715,   .12250/ 00002590
      DATA(KZ(I, 5,3),I=1,20)/  2.29285,  1.73537,  1.37794,  1.14016, 00002600
     1                           .97424,   .85162,   .75705,   .62075, 00002610
     2                           .52718,   .45888,   .38509,   .33241, 00002620
     3                           .29285,   .25319,   .22333,   .19494, 00002630
     4                           .17320,   .15296,   .13712,   .12248/ 00002640
      DATA(KZ(I, 6,3),I=1,20)/  1.89426,  1.58582,  1.30695,  1.10095, 00002650
     1                           .95013,   .83565,   .74590,   .61465, 00002660
     2                           .52346,   .45643,   .38364,   .33148, 00002670
     3                           .29221,   .25278,   .22304,   .19476, 00002680
     4                           .17307,   .15287,   .13706,   .12243/ 00002690
      DATA(KZ(I, 7,3),I=1,20)/  1.18622,  1.27152,  1.14802,  1.01046, 00002700
     1                           .89351,   .79777,   .71926,   .59994, 00002710
     2                           .51444,   .45048,   .38012,   .32921, 00002720
     3                           .29067,   .25178,   .22236,   .19430, 00002730
     4                           .17275,   .15265,   .13690,   .12232/ 00002740
      DATA(KZ(I, 8,3),I=1,20)/   .61600,   .93329,   .95745,   .89614, 00002750
     1                           .81987,   .74760,   .68354,   .57993, 00002760
     2                           .50207,   .44228,   .37525,   .32607, 00002770
     3                           .28851,   .25038,   .22140,   .19366, 00002780
     4                           .17230,   .15234,   .13667,   .12216/ 00002790
      DATA(KZ(I, 9,3),I=1,20)/   .09473,   .38574,   .57001,   .63589, 00002800
     1                           .64123,   .62097,   .59098,   .52637, 00002810
     2                           .46836,   .41966,   .36167,   .31726, 00002820
     3                           .28245,   .24644,   .21869,   .19185, 00002830
     4                           .17103,   .15146,   .13604,   .12171/ 00002840
      DATA(KZ(I,10,3),I=1,20)/   .00140,   .05283,   .17746,   .29387, 00002850
     1                           .36888,   .40901,   .42598,   .42326, 00002860
     2                           .40054,   .37291,   .33289,   .29828, 00002870
     3                           .26926,   .23780,   .21270,   .18784, 00002880
     4                           .16820,   .14951,   .13463,   .12070/ 00002890
      DATA(KZ(I,11,3),I=1,20)/   .00000,   .00033,   .00900,   .04088, 00002900
     1                           .08978,   .14070,   .18452,   .24245, 00002910
     2                           .25857,   .27575,   .26932,   .25479, 00002920
     3                           .23829,   .21706,   .19813,   .17796, 00002930
     4                           .16118,   .14462,   .13108,   .11816/ 00002940
      DATA(KZ(I,12,3),I=1,20)/   .00000,   .00000,   .00005,   .00124, 00002950
     1                           .00732,   .02119,   .04183,   .09023, 00002960
     2                           .13217,   .16143,   .18493,   .19264, 00002970
     3                           .19186,   .18463,   .17471,   .16170, 00002980
     4                           .14944,   .13634,   .12502,   .11378/ 00002990
      DATA(KZ(I,13,3),I=1,20)/   .00000,   .00000,   .00000,   .00000, 00003000
     1                           .00007,   .00060,   .00256,   .01404, 00003010
     2                           .03479,   .05892,   .09114,   .11381, 00003020
     3                           .12759,   .13615,   .13787,   .13501, 00003030
     4                           .12962,   .12202,   .11435,   .10597/ 00003040
      DATA(KZ(I,14,3),I=1,20)/   .00000,   .00000,   .00000,   .00000, 00003050
     1                           .00000,   .00000,   .00001,   .00027, 00003060
     2                           .00204,   .00692,   .02026,   .03720, 00003070
     3                           .05362,   .07126,   .08334,   .09203, 00003080
     4                           .09579,   .09639,   .09462,   .09110/ 00003090
C                                                                      00003100
C **** STABILITY CLASS D-DAY ****                                      00003110
C                                                                      00003120
      DATA(KZ(I, 1,4),I=1,20)/  6.49333,  4.96068,  4.08777,  3.51463, 00003130
     1                          3.17458,  2.91248,  2.70271,  2.38492, 00003140
     2                          2.15292,  1.97432,  1.77014,  1.61547, 00003150
     3                          1.49326,  1.36435,  1.26221,  1.16023, 00003160
     4                          1.07825,   .99836,   .93299,   .86997/ 00003170
      DATA(KZ(I, 2,4),I=1,20)/  6.08351,  4.77892,  3.98622,  3.45016, 00003180
     1                          3.12709,  2.87583,  2.67343,  2.36481, 00003190
     2                          2.13813,  1.96291,  1.76192,  1.60922, 00003200
     3                          1.48833,  1.36059,  1.25923,  1.15792, 00003210
     4                          1.07639,   .99689,   .93179,   .86900/ 00003220
      DATA(KZ(I, 3,4),I=1,20)/  5.45715,  4.49041,  3.82254,  3.34532, 00003230
     1                          3.04953,  2.81576,  2.62534,  2.33167, 00003240
     2                          2.11371,  1.94405,  1.74831,  1.59887, 00003250
     3                          1.48014,  1.35434,  1.25429,  1.15408, 00003260
     4                          1.07330,   .99444,   .92979,   .86737/ 00003270
      DATA(KZ(I, 4,4),I=1,20)/  3.85446,  3.67938,  3.34260,  3.03078, 00003280
     1                          2.81401,  2.63186,  2.47716,  2.22871, 00003290
     2                          2.03741,  1.88491,  1.70546,  1.56618, 00003300
     3                          1.45425,  1.33455,  1.23858,  1.14186, 00003310
     4                          1.06349,   .98664,   .92341,   .86220/ 00003320
      DATA(KZ(I, 5,4),I=1,20)/  2.28802,  2.72903,  2.73327,  2.61353, 00003330
     1                          2.49440,  2.37827,  2.27043,  2.08272, 00003340
     2                          1.92809,  1.79955,  1.64314,  1.51839, 00003350
     3                          1.41627,  1.30539,  1.21539,  1.12377, 00003360
     4                          1.04893,   .97505,   .91393,   .85450/ 00003370
      DATA(KZ(I, 6,4),I=1,20)/   .75533,  1.44629,  1.78219,  1.90781, 00003380
     1                          1.93064,  1.91761,  1.88663,  1.80348, 00003390
     2                          1.71487,  1.63077,  1.51817,  1.42162, 00003400
     3                          1.33881,  1.24554,  1.16755,  1.08629, 00003410
     4                          1.01864,   .95087,   .89411,   .83837/ 00003420
      DATA(KZ(I, 7,4),I=1,20)/   .04994,   .30506,   .62479,   .88207, 00003430
     1                          1.03037,  1.13134,  1.19832,  1.26728, 00003440
     2                          1.28673,  1.28105,  1.25059,  1.20973, 00003450
     3                          1.16641,  1.11019,  1.05810,   .99962, 00003460
     4                           .94807,   .89411,   .84733,   .80010/ 00003470
      DATA(KZ(I, 8,4),I=1,20)/   .00111,   .03453,   .14602,   .29955, 00003480
     1                           .42776,   .54045,   .63476,   .77329, 00003490
     2                           .86069,   .91371,   .95331,   .96507, 00003500
     3                           .96170,   .94505,   .92190,   .88978, 00003510
     4                           .85741,   .82030,   .78592,   .74944/ 00003520
      DATA(KZ(I, 9,4),I=1,20)/   .00000,   .00007,   .00218,   .01369, 00003530
     1                           .03470,   .06548,   .10331,   .18853, 00003540
     2                           .27282,   .34794,   .43896,   .50603, 00003550
     3                           .55407,   .59651,   .62186,   .63603, 00003560
     4                           .64337,   .64130,   .63390,   .62169/ 00003570
      DATA(KZ(I,10,4),I=1,20)/   .00000,   .00000,   .00000,   .00001, 00003580
     1                           .00012,   .00057,   .00174,   .00788, 00003590
     2                           .02057,   .03963,   .07666,   .11839, 00003600
     3                           .16024,   .21183,   .25643,   .30189, 00003610
     4                           .33715,   .36856,   .39081,   .40828/ 00003620
      DATA(KZ(I,11,4),I=1,20)/   .00000,   .00000,   .00000,   .00000, 00003630
     1                           .00000,   .00000,   .00000,   .00000, 00003640
     2                           .00003,   .00015,   .00089,   .00289, 00003650
     3                           .00673,   .01503,   .02665,   .04460, 00003660
     4                           .06466,   .08949,   .11354,   .13940/ 00003670
      DATA(KZ(I,12,4),I=1,20)/   .00000,   .00000,   .00000,   .00000, 00003680
     1                           .00000,   .00000,   .00000,   .00000, 00003690
     2                           .00000,   .00000,   .00000,   .00000, 00003700
     3                           .00002,   .00014,   .00048,   .00150, 00003710
     4                           .00345,   .00727,   .01267,   .02072/ 00003720
      DATA(KZ(I,13,4),I=1,20)/   .00000,   .00000,   .00000,   .00000, 00003730
     1                           .00000,   .00000,   .00000,   .00000, 00003740
     2                           .00000,   .00000,   .00000,   .00000, 00003750
     3                           .00000,   .00000,   .00000,   .00000, 00003760
     4                           .00001,   .00006,   .00020,   .00057/ 00003770
      DATA(KZ(I,14,4),I=1,20)/   .00000,   .00000,   .00000,   .00000, 00003780
     1                           .00000,   .00000,   .00000,   .00000, 00003790
     2                           .00000,   .00000,   .00000,   .00000, 00003800
     3                           .00000,   .00000,   .00000,   .00000, 00003810
     4                           .00000,   .00000,   .00000,   .00000/ 00003820
C                                                                       00003830
```

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C     **** STABILITY CLASS D-NIGHT ****                                 00003840
C                                                                       00003850
      DATA(KZ(I, 1,5),I=1,20)/       9.65877,  7.62365,  6.41190,  5.59502, 00003860
     1                               5.17247,  4.84007,  4.56863,  4.14725, 00003870
     2                               3.83100,  3.58197,  3.29066,  3.06473, 00003880
     3                               2.88267,  2.68687,  2.52872,  2.36788, 00003890
     4                               2.23625,  2.10582,  1.99733,  1.89113/ 00003900
      DATA(KZ(I, 2,5),I=1,20)/       8.28899,  6.95738,  6.01742,  5.33362, 00003910
     1                               4.56619,  4.67120,  4.42670,  4.04118, 00003920
     2                               3.74745,  3.51371,  3.23776,  3.02202, 00003930
     3                               2.84713,  2.65810,  2.50474,  2.34820, 00003940
     4                               2.21968,  2.09198,  1.98552,  1.88110/ 00003950
      DATA(KZ(I, 3,5),I=1,20)/       6.42394,  5.97380,  5.41315,  4.92482, 00003960
     1                               4.64050,  4.40275,  4.19990,  3.87041, 00003970
     2                               3.61224,  3.40282,  3.15149,  2.95214, 00003980
     3                               2.78387,  2.61083,  2.46528,  2.31576, 00003990
     4                               2.19232,  2.06911,  1.96600,  1.86452/ 00004000
      DATA(KZ(I, 4,5),I=1,20)/       2.84159,  3.66796,  3.85814,  3.81564, 00004010
     1                               3.73508,  3.64309,  3.54932,  3.37094, 00004020
     2                               3.21147,  3.07097,  2.89055,  2.73922, 00004030
     3                               2.61034,  2.46516,  2.34315,  2.21493, 00004040
     4                               2.10703,  1.99761,  1.90480,  1.81242/ 00004050
      DATA(KZ(I, 5,5),I=1,20)/        .83599,  1.76476,  2.32150,  2.63215, 00004060
     1                               2.69713,  2.74213,  2.75742,  2.73995, 00004070
     2                               2.69213,  2.63286,  2.53910,  2.44828, 00004080
     3                               2.36375,  2.26175,  2.17120,  2.07186, 00004090
     4                               1.98528,  1.89497,  1.81655,  1.73700/ 00004100
      DATA(KZ(I, 6,5),I=1,20)/        .06210,   .37281,   .78882,  1.15368, 00004110
     1                               1.35030,  1.49935,  1.61256,  1.76390, 00004120
     2                               1.85057,  1.89836,  1.92769,  1.92856, 00004130
     3                               1.91434,  1.88352,  1.84656,  1.79777, 00004140
     4                               1.74940,  1.69402,  1.64237,  1.58698/ 00004150
      DATA(KZ(I, 7,5),I=1,20)/        .00011,   .00825,   .05597,   .15714, 00004160
     1                                .24773,   .34142,   .43298,   .59934, 00004170
     2                                .73842,   .85157,   .98129,  1.07460, 00004180
     3                               1.14171,  1.20276,  1.24157,  1.26967, 00004190
     4                               1.28308,  1.28706,  1.28285,  1.27181/ 00004200
      DATA(KZ(I, 8,5),I=1,20)/        .00000,   .00004,   .00138,   .00964, 00004210
     1                                .02306,   .04302,   .06871,   .13224, 00004220
     2                                .20404,   .27720,   .38130,   .47387, 00004230
     3                                .55374,   .64190,   .71223,   .78024, 00004240
     4                                .83131,   .87609,   .90774,   .93285/ 00004250
      DATA(KZ(I, 9,5),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00004260
     1                                .00003,   .00012,   .00036,   .00176, 00004270
     2                                .00517,   .01122,   .02560,   .04568, 00004280
     3                                .07006,   .10673,   .14556,   .19411, 00004290
     4                                .24056,   .29192,   .33790,   .38479/ 00004300
      DATA(KZ(I,10,5),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00004310
     1                                .00000,   .00000,   .00000,   .00000, 00004320
     2                                .00000,   .00001,   .00006,   .00024, 00004330
     3                                .00067,   .00188,   .00409,   .00849, 00004340
     4                                .01477,   .02463,   .03657,   .05247/ 00004350
      DATA(KZ(I,11,5),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00004360
     1                                .00000,   .00000,   .00000,   .00000, 00004370
     2                                .00000,   .00000,   .00000,   .00000, 00004380
     3                                .00000,   .00000,   .00000,   .00000, 00004390
     4                                .00001,   .00004,   .00012,   .00032/ 00004400
      DATA(KZ(I,12,5),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00004410
     1                                .00000,   .00000,   .00000,   .00000, 00004420
     2                                .00000,   .00000,   .00000,   .00000, 00004430
     3                                .00000,   .00000,   .00000,   .00000, 00004440
     4                                .00000,   .00000,   .00000,   .00000/ 00004450
      DATA(KZ(I,13,5),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00004460
     1                                .00000,   .00000,   .00000,   .00000, 00004470
     2                                .00000,   .00000,   .00000,   .00000, 00004480
     3                                .00000,   .00000,   .00000,   .00000, 00004490
     4                                .00000,   .00000,   .00000,   .00000/ 00004500
      DATA(KZ(I,14,5),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00004510
     1                                .00000,   .00000,   .00000,   .00000, 00004520
     2                                .00000,   .00000,   .00000,   .00000, 00004530
     3                                .00000,   .00000,   .00000,   .00000, 00004540
     4                                .00000,   .00000,   .00000,   .00000/ 00004550
C                                                                           00004560
C    **** STABILITY CLASS E ****                                            00004570
C                                                                           00004580
      DATA(KZ(I, 1,6),I=1,20)/       9.80888,  7.74270,  6.51101,  5.68039, 00004590
     1                               5.21764,  4.85436,  4.55921,  4.10395, 00004600
     2                               3.76483,  3.49947,  3.19108,  2.95354, 00004610
     3                               2.76321,  2.55970,  2.39627,  2.23099, 00004620
     4                               2.09645,  1.96382,  1.85404,  1.74709/ 00004630
      DATA(KZ(I, 2,6),I=1,20)/       8.37286,  7.04435,  6.09781,  5.40677, 00004640
     1                               5.00588,  4.68399,  4.41817,  4.00119, 00004650
     2                               3.68555,  3.43583,  3.14285,  2.91531, 00004660
     3                               2.73192,  2.53433,  2.37587,  2.21453, 00004670
     4                               2.08280,  1.95259,  1.84460,  1.73919/ 00004680
      DATA(KZ(I, 3,6),I=1,20)/       6.43129,  6.01758,  5.46659,  4.97972, 00004690
     1                               4.67187,  4.41322,  4.19272,  3.83560, 00004700
     2                               3.55711,  3.33232,  3.06409,  2.85270, 00004710
     3                               2.68055,  2.49392,  2.34226,  2.18737, 00004720
     4                               2.06023,  1.93403,  1.82897,  1.72610/ 00004730
      DATA(KZ(I, 4,6),I=1,20)/       2.76474,  3.63481,  3.85348,  3.82700, 00004740
     1                               3.74563,  3.64756,  3.54576,  3.35039, 00004750
     2                               3.17540,  3.02160,  2.82505,  2.66123, 00004760
     3                               2.52255,  2.36738,  2.23786,  2.10257, 00004770
     4                               1.98966,  1.87581,  1.77983,  1.68408/ 00004780
      DATA(KZ(I, 5,6),I=1,20)/        .77927,  1.70636,  2.28064,  2.57833, 00004790
     1                               2.68391,  2.74078,  2.75759,  2.73519, 00004800
     2                               2.67826,  2.60899,  2.50101,  2.39784, 00004810
     3                               2.30287,  2.18951,  2.08992,  1.98172, 00004820
     4                               1.88831,  1.79174,  1.70859,  1.62488/ 00004830
      DATA(KZ(I, 6,6),I=1,20)/        .05285,   .34214,   .74816,  1.11393, 00004840
     1                               1.32949,  1.49314,  1.61630,  1.77729, 00004850
     2                               1.86516,  1.90973,  1.93054,  1.92151, 00004860
     3                               1.89749,  1.85466,  1.80721,  1.74731, 00004870
     4                               1.68976,  1.62541,  1.56652,  1.50438/ 00004880
      DATA(KZ(I, 7,6),I=1,20)/        .00007,   .00666,   .04870,   .14241, 00004890
     1                                .23656,   .33697,   .43639,   .61783, 00004900
     2                                .76838,   .88892,  1.02352,  1.11663, 00004910
     3                               1.18052,  1.23479,  1.26561,  1.28342, 00004920
     4                               1.28697,  1.28012,  1.26630,  1.24549/ 00004930
      DATA(KZ(I, 8,6),I=1,20)/        .00000,   .00003,   .00106,   .00800, 00004940
     1                                .02110,   .04193,   .06979,   .14074, 00004950
     2                                .22201,   .30472,   .42100,   .52225, 00004960
     3                                .60747,   .69863,   .76862,   .83324, 00004970
     4                                .87904,   .91634,   .94010,   .95613/ 00004980
      DATA(KZ(I, 9,6),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00004990
     1                                .00002,   .00011,   .00037,   .00206, 00005000
     2                                .00639,   .01430,   .03326,   .05956, 00005010
     3                                .09101,   .13726,   .18487,   .24253, 00005020
     4                                .29579,   .35254,   .40139,   .44920/ 00005030
      DATA(KZ(I,10,6),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00005040
     1                                .00000,   .00000,   .00000,   .00000, 00005050
     2                                .00000,   .00001,   .00011,   .00045, 00005060
     3                                .00127,   .00353,   .00749,   .01509, 00005070
     4                                .02551,   .04110,   .05915,   .08209/ 00005080
      DATA(KZ(I,11,6),I=1,20)/        .00000,   .00000,   .00000,   .00000, 00005090
     1                                .00000,   .00000,   .00000,   .00000, 00005100
     2                                .00000,   .00000,   .00000,   .00000, 00005110
     3
     4                          .00000,   .00000,   .00000,   .00001, 00005120
     DATA(KZ(I,12,6),I=1,20)/   .00005,   .00017,   .00044,   .00107/ 00005130
     1                          .00000,   .00000,   .00000,   .00000, 00005140
     2                          .00000,   .00000,   .00000,   .00000, 00005150
     3                          .00000,   .00000,   .00000,   .00000, 00005160
     4                          .00000,   .00000,   .00000,   .00000, 00005170
     DATA(KZ(I,13,6),I=1,20)/   .00000,   .00000,   .00000,   .00000/ 00005180
     1                          .00000,   .00000,   .00000,   .00000, 00005190
     2                          .00000,   .00000,   .00000,   .00000, 00005200
     3                          .00000,   .00000,   .00000,   .00000, 00005210
     4                          .00000,   .00000,   .00000,   .00000, 00005220
     DATA(KZ(I,14,6),I=1,20)/   .00000,   .00000,   .00000,   .00000/ 00005230
     1                          .00000,   .00000,   .00000,   .00000, 00005240
     2                          .00000,   .00000,   .00000,   .00000, 00005250
     3                          .00000,   .00000,   .00000,   .00000, 00005260
     4                          .00000,   .00000,   .00000,   .00000, 00005270
C                               .00000,   .00000,   .00000,   .00000/ 00005280
C  **** STABILITY CLASS F ****                                        00005290
C                                                                     00005300
     DATA(KZ(I, 1,7),I=1,20)/                                         00005310
     1                        14.31452, 11.77793, 10.12748,  8.96400, 00005320
     2                         8.42103,  7.99096,  7.63355,  7.06707, 00005330
     3                         6.63212,  6.28333,  5.86786,  5.53975, 00005340
     4                         5.27137,  4.97853,  4.73865,  4.49142, 00005350
     DATA(KZ(I, 2,7),I=1,20)/  4.28648,  4.08096,  3.90805,  3.73697/ 00005360
     1                         9.64684,  9.25382,  8.54358,  7.87359, 00005370
     2                         7.51964,  7.22237,  6.96465,  6.53758, 00005380
     3                         6.19524,  5.91228,  5.56607,  5.28607, 00005390
     4                         5.05297,  4.79469,  4.58022,  4.35660, 00005400
     DATA(KZ(I, 3,7),I=1,20)/  4.16934,  3.97991,  3.81935,  3.65944/ 00005410
     1                         4.99726,  6.19072,  6.43483,  6.34295, 00005420
     2                         6.22659,  6.10213,  5.97751,  5.74178, 00005430
     3                         5.53011,  5.34191,  5.09719,  4.88881, 00005440
     4                         4.70889,  4.50325,  4.32785,  4.14082, 00005450
     DATA(KZ(I, 4,7),I=1,20)/  3.98117,  3.81704,  3.67596,  3.53378/ 00005460
     1                          .60903,  1.71036,  2.59781,  3.17592, 00005470
     2                         3.40423,  3.55833,  3.66530,  3.79019, 00005480
     3                         3.84501,  3.86109,  3.84620,  3.80741, 00005490
     4                         3.75758,  3.68447,  3.61001,  3.51960, 00005500
     DATA(KZ(I, 5,7),I=1,20)/  3.43424,  3.33930,  3.25231,  3.15994/ 00005510
     1                          .02591,   .24837,   .66637,  1.12522, 00005520
     2                         1.37617,  1.58451,  1.75991,  2.03275, 00005530
     3                         2.22916,  2.37263,  2.52107,  2.61678, 00005540
     4                         2.67850,  2.72678,  2.75019,  2.75805, 00005550
     DATA(KZ(I, 6,7),I=1,20)/  2.75145,  2.73244,  2.70659,  2.67201/ 00005560
     1                          .00003,   .00412,   .03699,   .12406, 00005570
     2                          .20082,   .28397,   .37019,   .54089, 00005580
     3                          .69990,   .84302,  1.02745,  1.17947, 00005590
     4                         1.30462,  1.43832,  1.54277,  1.64280, 00005600
     DATA(KZ(I, 7,7),I=1,20)/  1.71786,  1.78423,  1.83195,  1.87090/ 00005610
     1                          .00000,   .00000,   .00003,   .00056, 00005620
     2                          .00180,   .00420,   .00811,   .02108, 00005630
     3                          .04092,   .06674,   .11384,   .16728, 00005640
     4                          .22376,   .29991,   .37407,   .46140, 00005650
     DATA(KZ(I, 8,7),I=1,20)/   .54148,   .62773,   .70380,   .78104/ 00005660
     1                          .00000,   .00000,   .00000,   .00000, 00005670
     2                          .00000,   .00001,   .00004,   .00022, 00005680
     3                          .00077,   .00192,   .00523,   .01086, 00005690
     4                          .01396,   .03340,   .05146,   .07798, 00005700
     DATA(KZ(I, 9,7),I=1,20)/   .10755,   .14542,   .18442,   .22990/ 00005710
     1                          .00000,   .00000,   .00000,   .00000, 00005720
     2                          .00000,   .00000,   .00000,   .00000, 00005730
     3                          .00000,   .00000,   .00000,   .00000, 00005740
                                .00002,   .00006,   .00018,   .00049, 00005750
     4                              .00106,   .00223,   .00402,   .00698/
      DATA(KZ(I,10,7),I=1,20)/      .00000,   .00000,   .00000,   .00000,
     1                              .00000,   .00000,   .00000,   .00000,
     2                              .00000,   .00000,   .00000,   .00000,
     3                              .00000,   .00000,   .00000,   .00000,
     4                              .00000,   .00000,   .00000,   .00000/
      DATA(KZ(I,11,7),I=1,20)/      .00000,   .00000,   .00000,   .00000,
     1                              .00000,   .00000,   .00000,   .00000,
     2                              .00000,   .00000,   .00000,   .00000,
     3                              .00000,   .00000,   .00000,   .00000,
     4                              .00000,   .00000,   .00000,   .00000/
      DATA(KZ(I,12,7),I=1,20)/      .00000,   .00000,   .00000,   .00000,
     1                              .00000,   .00000,   .00000,   .00000,
     2                              .00000,   .00000,   .00000,   .00000,
     3                              .00000,   .00000,   .00000,   .00000,
     4                              .00000,   .00000,   .00000,   .00000/
      DATA(KZ(I,13,7),I=1,20)/      .00000,   .00000,   .00000,   .00000,
     1                              .00000,   .00000,   .00000,   .00000,
     2                              .00000,   .00000,   .00000,   .00000,
     3                              .00000,   .00000,   .00000,   .00000,
     4                              .00000,   .00000,   .00000,   .00000/
      DATA(KZ(I,14,7),I=1,20)/      .00000,   .00000,   .00000,   .00000,
     1                              .00000,   .00000,   .00000,   .00000,
     2                              .00000,   .00000,   .00000,   .00000,
     3                              .00000,   .00000,   .00000,   .00000,
     4                              .00000,   .00000,   .00000,   .00000/
C
      INDEX=0
C
C  CALL INPUT MODULE TO READ IN ALL WEATHER AND SOURCE INFORMATION.
C
      CALL INMOD
      INDEX=1
C
C  CALL SUBROUTINE INDATA TO SELECT THE PROPER DATA FOR
C  KY, DEL, AND ANGLIM DEPENDING ON THE TIME SPAN OPTION NTOPT
      CALL INDATA(NTOPT,ANGLIM,DEL)
C
C  CALL INPUT MODULE TO BRING IN WEATHER DATA FOR ONE SCENARIO
C    (NUMBER OF SCENARIO = ISCEN).
C
100   CALL INMOD
C
      IF(NTOPT.LT.5) STCONV = 1.
      IF(NTOPT.EQ.5) STCONV= 0.125
      IF(NTOPT.EQ.6) STCONV= 0.04166667
      IF(NTOPT.EQ.7.OR.NTOPT.EQ.8) STCONV= 1.0/FLOAT(NSCEN)
C
C  CALCULATE WIND VECTOR (WVEC) FOR SCENARIO. IFLAG IS USED BELOW
C    (STMT. 275) TO DETERMINE METHOD OF RESTRICTING THE AREA OF THE
C    RECEPTOR GRID AFFECTED BY EACH SOURCE.
C
175   IF(NWDOPT.EQ.1) GO TO 200
      DO 180 IWD=1,16
      DETA=ABS(WD(ISCEN)-SECTAN(IWD))
      IF(DETA.LE.0.19634954) GO TO 185
180   CONTINUE
185   GO TO 205
200   WD(ISCEN)=SECTAN(IWD)
205   IF(IWD.LT.8.OR.IWD.GT.10) GO TO 210
      IFLAG=1
      GO TO 241
210   IF(IWD.NE.11) GO TO 215
      IFLAG=2
      GO TO 241
215   IF(IW).LT.12.OR.IWD.GT.14) GO TO 220
      IFLAG=3
      GO TO 241
220   IF(IW).NE.15) GO TO 225
      IFLAG=4
      GO TO 241
225   IF(IW).LT.16.AN).IW).GT.2) GO TO 230
      IFLAG=5
      GO TO 241
230   IF(IWD.NE.3) GO TO 235
      IFLAG=6
      GO TO 241
235   IF(IWD.LT.4.rR.IWD.GT.6) GO TO 240
      IFLAG=7
      GO TO 241
240   IFLAG=8
241   WVEC= WD(ISCrN) + 3.14152265
      IF(WVEC.GT.6.2831853) WVEC=WVEC - 6.2831853
      WDV=4.712388r81-WD(ISCEN)
      IF(WDV.LT.0.) WDV=WDV+6.283185307
      WDPANG=WDV+ArGLIM(ISC)
      W)MANG=WDV-ANGLIM(ISC)
C  CALL AUTGRD TO rALCULATE ?ECEPTOR GRID PARAMETERS AUTOMATICALLY.
      IF(IGRID.EQ.1) CALL AUTGRD
C
C  INITIALIZE CONCrNTRATION GRID
      IF(NTOPT.GE.5.AND.ISCEN.NE.1) GO TO 4
      DO 2 I=1,LX
      DO 2 J=1,LY
2     CONC(I,J,1)=r.
4     IF(NPOL.EQ.2.AND.NTOPT.GE.5.ANC.ISCEN.GT.1) GO TO 8
      DO 6 I=1,LX
      DO 6 J=1,LY
6     CONC(I,J,2)=r.
8     CONTINUE
C
      VGRID= 1./GRTD
      GRIDSQ= GRID*GRID
      ELX= LX
      ELY= LY
      XB1= XSWC + r.5*GRID
      XB2= XSWC + (ELX-0.5)*GRID
      YB1= YSWC + r.5*GRID
      YB2= YSWC + (ELY-0.5)*GRID
C
C  IF NO AREA SOURrES, SKIP AREA SOURCE CALCULATIONS.
      IF(NAS.LT.1) GO TO 245
C
C***  A R E A   S O U R C E   C A L C U L A T I O N S  ***
C
C     IWV HELPS DETrRMINE THE PATTERN OF GRID SQUARES AFFECTED BY EACH
C     AREA SOURCE.  PATTERN DEPENDS ONLY ON WIND DIRECTION.
C     EPS IS THE ANGLE BETWEEN THE WIND VECTOR AND THE NEAREST
C     COORDINATE AXIS.
C
      IWV= 1 + WVEr/0.78540
      GO TO (2411,?412,2413,2414,2415,2416,2417,2418),IWV
2411  ITABX=1
      ISIGNX=1
      ISIGNY=1
      EPS= WVEC
      GO TO 2419
2412  ITABX=0
```

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      ISIGNX=1
      ISIGNY=1
      EPS= 1.5708 - WVEC
      GO TO 2419
 2413 ITABX=0
      ISIGNX=1
      ISIGNY=-1
      EPS= WVEC - 1.57080
      GO TO 2419
 2414 ITABX=1
      ISIGNX=1
      ISIGNY=-1
      EPS= 3.1416 - WVEC
      GO TO 2419
 2415 ITABX=1
      ISIGNX=-1
      ISIGNY=-1
      EPS= WVEC - 3.1416
      GO TO 2419
 2416 ITABX=0
      ISIGNX=-1
      ISIGNY=-1
      EPS= 4.7124 - WVEC
      GO TO 2419
 2417 ITABX=0
      ISIGNX=-1
      ISIGNY=1
      EPS= WVEC - 4.7124
      GO TO 2419
 2418 ITABX=1
      ISIGNX=-1
      ISIGNY=1
      EPS= 6.2832 - WVEC
 2419 IF(ITABX.EQ.0) GO TO 2420
      ITABY=0
      INCRX=0
      INCRY=1
      GO TO 2421
 2420 ITABY=1
      INCRX=1
      INCRY=0
 2421 DO 2422 L=1,10
      IF(EPS.GT.EPSLIM(L)) GO TO 2422
      IEPS=L
      GO TO 2423
 2422 CONTINUE
      IEPS=10
C
C  CALCULATE COEFFICIENTS FOR GIFFORD-HANNA AREA SOURCE ALGORITHM.
C
 2423 IA= ISC-1
      IF(IA.EQ.0) IA=1
      AA= AAR(IA)
      BA= 1. - BAR(IA)
      QC= (0.7978856*(500.*GRID/COS(EPS))**BA)/(WS(ISCEN)*AA*BA)
      Q3= 3.**BA
      Q5= 5.**BA
      Q7= 7.**BA
      Q9= 9.**BA
      QN(1)= 1.
      QN(2)= Q3 - 1.
      QN(3)= Q5 - Q3
      QN(4)= Q7 - Q5
      QN(5)= Q9 - Q7
```

```
C
C
C  LOOP THROUGH ALL AREA SOURCES.  EMISSIONS FROM EACH AREA SOURCE
C    ARE APPORTIONED AMONG THE RECEPTOR GRID SQUARES WHOLLY OR
C    PARTIALLY COVERED BY THE SOURCE.  EACH AFFECTED RECEPTOR GRID
C    SQUARE IS TREATED AS A SOURCE.
C
      DO 2429 K=1,NAS
      AREA= SIZE(K)*SIZE(K)
      AX1= XA(K)
      AX2= AX1 + SIZE(K)
      NX1= (AX1-XSWC)*VGRID + 5.
      NX2= (AX2-XSWC)*VGRID + 5.
      IF(NX1.GT.LX+8.OR.NX2.LT.1) GO TO 2429
      IF(NX1.GE.1) GO TO 32
      NX1= 1
      AX1= XSWC - 4.*GRID
32    IF(NX2.LE.LX+8) GO TO 34
      NX2= LX+8
      AX2= XSWC + (ELX + 4.)*GRID
34    X1= XSWC + (FLOAT(NX1)-5.)*GRID
      X2= XSWC + (FLOAT(NX2)-4.)*GRID
      AY1= YA(K)
      AY2= AY1 + SIZE(K)
      NY1= (AY1-YSWC)*VGRID + 5.
      NY2= (AY2-YSWC)*VGRID + 5.
      IF(NY1.GT.LY+8.OR.NY2.LT.1) GO TO 2429
      IF(NY1.GE.1) GO TO 36
      NY1= 1
      AY1= YSWC - 4.*GRID
36    IF(NY2.LE.LY+8) GO TO 38
      NY2= LY+8
      AY2= YSWC + (ELY + 4.)*GRID
38    Y1= YSWC + (FLOAT(NY1)-5.)*GRID
      Y2= YSWC + (FLOAT(NY2)-4.)*GRID
      DO 2428 IX=NX1,NX2
      IF(NX1.NE.NX2) GO TO 10
      DX= AX2-AX1
      GO TO 13
10    IF(IX.NE.NX1) GO TO 11
      DX= GRID+X1-AX1
      GO TO 13
11    IF(IX.NE.NX2) GO TO 12
      DX= GRID+AX2-X2
      GO TO 13
12    DX=GRID
13    DO 2427 JY=NY1,NY2
      IF(NY1.NE.NY2) GO TO 20
      DY= AY2-AY1
      GO TO 23
20    IF(JY.NE.NY1) GO TO 21
      DY= GRID+Y1-AY1
      GO TO 23
21    IF(JY.NE.NY2) GO TO 22
      DY= GRID+AY2-Y2
      GO TO 23
22    DY=GRID
23    SPLIT= DX*DY/(AREA*GRIDSQ)
C
C  LOOP FOR THE FIVE RECEPTORS AFFECTED BY EACH RECEPTOR GRID SQUARE
C    CONTAINING EMISSIONS.  THE RECEPTORS IN THE FOUR DOWNWIND SQUARES
C    AND IN THE SOURCE SQUARE ITSELF ARE AFFECTED.
C
      DO 2426 L=1,5
      NX= IX + ISIGNX*(ITABLE(L,IEPS)*ITABX + (L-1)*INCRX) - 4
      IF(NX.LT.1.OR.NX.GT.LX) GO TO 2426
      NY= JY + ISIGNY*(ITABLE(L,IEPS)*ITABY + (L-1)*INCRY) - 4
      IF(NY.LT.1.OR.NY.GT.LY) GO TO 2426
      DO 2425 M=1,NPOL
      IF(INPOL.EQ.7) MAQ=2
      IF(INPOL.NE.7) MAQ=M
C
C  CALCULATE CONCENTRATION OF POLLUTANT M AT RECEPTOR IN COLUMN NX,
C    ROW NY OF THE RECEPTOR GRID DUE TO AREA SOURCE K.
C
2425  CONC(NX,NY,M)= CONC(NX,NY,M) + QC*QN(L)*EA(K,MAQ)*SPLIT
2426  CONTINUE
2427  CONTINUE
2428  CONTINUE
2429  CONTINUE
C
C  HPEN= MINIMUM EFFECTIVE SOURCE HEIGHT NECESSARY FOR PLUME TO
C    PENETRATE INVERSION.
245   HPEN= PEN(ISCEN)*HMIX(ISCEN)
C
C  CALCULATE KZC USED LATER FOR MIXING HEIGHT EFFECTS.
C
      TOTKZ=398.9423/HMIX(ISCEN)
C
C  IF NO POINT SOURCES, SKIP POINT SOURCE CALCULATIONS.
      IF(NPS.LT.1) GO TO 603
C
C***  P O I N T   S O U R C E   C A L C U L A T I O N S  ***
C
C  LOOP THROUGH ALL POINT SOURCES.
      DO 600 I=1,NPS
      IF((NWDOPT.GT.1.AND.IWDOPT.GT.1).OR.NTOPT.EQ.6) GO TO 246
      IF(NPRINT.EQ.0) GO TO 246
      IF((I-1)/50*50.EQ.I-1) WRITE(IWR,1005)TT,ISCEN,HMIX(ISCEN),HPEN
246   IPS=I
      IF(HP(I).GE.HMIX(ISCEN)) GO TO 600
      IRISE=2
      IBUOY=1
     EFF= 2.45*VP(I)*DP(I)*DP(I)*(TP(I)-TA(ISCEN))/TP(I)
      IF(EFF.LT.0.) EFF=1.0E-7
C
C  CALCULATE INVERSE WIND SPEED (UINV) AT THE PHYSICAL HEIGHT (HP(I))
C    OF POINT SOURCE I.  DO NOT CHANGE IF STACK HEIGHT IS LESS
C    THAN 10 METERS.
C
      UINV = 1./WS(ISCEN)
      IF(HP(I).GT.10.) UINV = UINV*((10./HP(I))**P(ISC))
      IF(ISC.LT.6) GO TO 247
C
C  DETERMINE WHETHER PLUME IS MOMENTUM-DOMINATED (IBUOY=0),
C                            OR BUOYANCY-DOMINATED (IBUOY=1).
C
C
C  THE VALUES GIVEN BELOW FOR BRIGC ARE FOR GENERAL USE.  WITHIN
C  TEXAS, THE STAFF OF TACB GENERALLY WILL ASSUME A POTENTIAL
C  TEMPERATURE GRADIENT OF 0.018 FOR CLASS E AND 0.025 FOR CLASS F.
C  THEREFORE, THE VALUE OF BRIGC FOR CLASS E AND F IS 121.51 AND
C  103.11 RESPECTIVELY FOR TEXAS SOURCES MODELED BY TACB.
C
C
      IF(ISC.EQ.6) BRIGC=115.28
      IF(ISC.EQ.7) BRIGC=87.14
      IF(VP(I).GT.BRIGC*(TP(I)-TA(ISCEN))*SQRT(TA(ISCEN))/TP(I)) IBUOY=0
      GO TO 249
247   AF= 21.425
      BF= 0.75
      IF(EFF.LT.55.) GO TO 248
      AF= 38.710
      BF= 0.6
248   IF(3.*VP(I)*DP(I).GT.AF*EFF**BF) IBUOY=0
249   CONTINUE
C
C  CALL SUBROUTINE RISE WITH IRISE=2 TO GET PEAK EFFECTIVE SOURCE
C    HEIGHT, ESH(2).
C
      CALL RISE
      IRISE=1
      IF(NPRINT.EQ.0) GO TO 1250
      IF(NWDOPT.LE.1.OR.IWDOPT.LE.1) WRITE(IWR,1010)
     1 I,XP(I),YP(I),EP(I,1),EP(I,2),HP(I),DP(I),VP(I),
     2 TP(I),PRL(1,IBUOY+1),PRL(2,IBUOY+1),DWL(IDWN),DWL(IDWN+1),ESH(2)
C
C  CALCULATE DISTANCE AT WHICH PLUME REACHES MAXIMUM HEIGHT (PEAK).
C
 1250 IF(IBUOY.EQ.0) GO TO 252
      IF(ISC.LT.6) GO TO 250
      PEAK=0.0020748/(UINV*SQRT(DTDZ(ISC-5)*9.8/TA(ISCEN)))
      GO TO 253
250   PEAK=0.001*XS
      GO TO 253
252   PEAK= 0.
      IF(ISC.GE.6) GO TO 253
      IF(ABS(VP(I)).LT..000001) GO TO 253
      PEAK=(0.004*UINV*(DP(I)*(VP(I) + 3./UINV))**2)/VP(I)
C
C  IF MAXIMUM EFFECTIVE SOURCE HEIGHT EXCEEDS HPEN, PLUME ESCAPES
C    THE MIXING LAYER, AND SOURCE IS IGNORED.
C
253   IF(ESH(2).GT.HPEN) GO TO 600
C
C  IF MAXIMUM EFFECTIVE SOURCE HEIGHT EXCEEDS MIXING HEIGHT BUT
C    NOT HPEN, PLUME DOES NOT ESCAPE THE MIXING LAYER, AND MAXIMUM
C    EFFECTIVE SOURCE HEIGHT IS SET EQUAL TO THE MIXING HEIGHT.
C
      IF(ESH(2).GT.HMIX(ISCEN)) ESH(2)=HMIX(ISCEN)
C
C  CALCULATE POLLUTANT DECAY FACTORS.
      DO 254 J=1,20
      DIST= DLIM(J)*1000.
      DO 254 K=1,NPOL
      IF(INPOL.EQ.2) MAQ= 2
      IF(INPOL.NE.2) MAQ= K
254   DECAY(J,K)= EXP(-0.692*DIST*UINV/HALF(ISCEN,MAQ))
C
C  CALCULATE FACTORS NSH AND FSH FOR LINEAR INTERPOLATION TO THE
C    CORRECT EFFECTIVE SOURCE HEIGHT IN THE KZ TABLE.
C
      IF(ESH(2).GT.HLIM(1)) GO TO 255
      NSH=1
      FSH=0.
      GO TO 275
255   IF(ESH(2).LT.HLIM(14)) GO TO 260
      NSH=13
      FSH=1.
      GO TO 275
260   DO 265 J=2,14
      IF(ESH(2).LE.HLIM(J)) GO TO 270
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265    CONTINUE
       J=14
270    NSH=J-1
       FSH= (ESH(2)-HLIM(J-1))/(HLIM(J)-HLIM(J-1))
C
C  SET LIMITS (XMIN,XMAX,YMIN,YMAX) ON PORTION OF RECEPTOR GRID
C     EXAMINED FOR EACH SOURCE. THE EXTENT OF THIS PORTION DEPENDS
C     ON SOURCE LOCATION, GRID DIMENSIONS, AND WIND DIRECTION.
C
275    XMAX= XB2
       XMIN= XB1
       YMAX= YB2
       YMIN= YB1
       IF(XP(I)+60.0.LT.XB2) XMAX= XP(I) + 60.
       IF(XP(I)-60.0.GT.XB1) XMIN= XP(I) - 60.
       IF(YP(I)+60.0.LT.YB2) YMAX= YP(I) + 60.
       IF(YP(I)-60.0.GT.YB1) YMIN= YP(I) - 60.
       GO TO (280,285,290,295,300,305,310,315),IFLAG
 280   IF(WDPANG.GT.3.14) GO TO 282
       IF(WDMANG.LT.0.) GO TO 284
       YMIN= YP(I)
       XL1=XP(I)+(YB2-YP(I))/TAN(WDPANG)
       IF(XL1.GT.XMIN) XMIN=XL1
       IF(XL1.GT.XP(I)) XMIN=XP(I)
       XL2=XP(I)+(YB2-YP(I))/TAN(WDMANG)
       IF(XL2.LT.XMAX) XMAX=XL2
       IF(XL2.LT.XP(I)) XMAX=XP(I)
       GO TO 320
 282   YMIN= YP(I)+(YB1-XP(I))*TAN(WDPANG)
       XMAX=XP(I)+(YB2-YP(I))/TAN(WDMANG)
       GO TO 320
 284   YMIN=YP(I)+(YB2-XP(I))*TAN(WDMANG)
       XMIN=XP(I)+(YB2-YP(I))/TAN(WDPANG)
       GO TO 320
 285   XL1=XP(I)+(YB2-YP(I))/TAN(WDPANG)
       IF(XL1.GT.XMIN) XMIN=XL1
       IF(XL1.GT.XP(I)) XMIN=XP(I)
       YL1=YP(I)+(XB2-XP(I))*TAN(WDMANG)
       IF(YL1.GT.YMIN) YMIN=YL1
       IF(YL1.GT.YP(I)) YMIN=YP(I)
       GO TO 320
 290   IF(WDPANG.GT.1.57.AND.WDMANG.LT.0.) GO TO 292
       IF(WDPANG.GT.6.28.AND.WDMANG.LT.4.712) GO TO 294
       XMIN=XP(I)
       YL1=YP(I)+(XB2-XP(I))*TAN(WDMANG)
       IF(YL1.GT.YMIN) YMIN=YL1
       IF(YL1.GT.YP(I)) YMIN=YP(I)
       YL2=YP(I)+(XB2-XP(I))*TAN(WDPANG)
       IF(YL2.LT.YMAX) YMAX=YL2
       IF(YL2.LT.YP(I)) YMAX=YP(I)
       GO TO 320
 292   YMIN= YP(I)+(XB2-XP(I))*TAN(WDMANG)
       XMIN=XP(I)+(YB2-YP(I))/TAN(WDPANG)
       GO TO 320
 294   XMIN=XP(I)+(YB1-YP(I))/TAN(WDMANG)
       YMAX= YP(I)+(YB2-XP(I))*TAN(WDPANG)
       GO TO 320
 295   XL1=XP(I)+(YB1-YP(I))/TAN(WDMANG)
       IF(XL1.GT.XMIN) XMIN=XL1
       IF(XL1.GT.XP(I)) XMIN=XP(I)
       YL2=YP(I)+(XB2-XP(I))*TAN(WDPANG)
       IF(YL2.LT.YMAX) YMAX=YL2
       IF(YL2.LT.YP(I)) YMAX=YP(I)
       GO TO 320
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  300 IF(WDPANG.GT.6.28) GO TO 302
      IF(WDMANG.LT.3.14) GO TO 304
      YMAX=YP(I)
      XL1=XP(I)+(YB1-YP(I))/TAN(WDMANG)
      IF(XL1.GT.XMIN) XMIN=XL1
      IF(XL1.GT.XP(I)) XMIN=XP(I)
      XL2=XP(I)+(YB1-YP(I))/TAN(WDPANG)
      IF(XL2.LT.XMAX) XMAX=XL2
      IF(XL2.LT.XP(I)) XMAX=XP(I)
      GO TO 320
  302 YMAX=YP(I)+(YB2-XP(I))*TAN(WDPANG)
      XMIN=XP(I)+(YB1-YP(I))/TAN(WDMANG)
      GO TO 320
  304 YMAX=YP(I)+(YB1-XP(I))*TAN(WDMANG)
      XMAX=XP(I)+(YB1-YP(I))/TAN(WDPANG)
      GO TO 320
  305 YL2=YP(I)+(XB1-XP(I))*TAN(WDMANG)
      IF(YL2.LT.YMAX) YMAX=YL2
      IF(YL2.LT.YP(I)) YMAX=YP(I)
      XL2=XP(I)+(YB1-YP(I))/TAN(WDPANG)
      IF(XL2.LT.XMAX) XMAX=XL2
      IF(XL2.LT.XP(I)) XMAX=XP(I)
      GO TO 320
  310 IF(WDMANG.LT.1.57) GO TO 312
      IF(WDPANG.GT.4.712) GO TO 314
      XMAX=XP(I)
      YL1=YP(I)+(XB1-XP(I))*TAN(WDPANG)
      IF(YL1.GT.YMIN) YMIN=YL1
      IF(YL1.GT.YP(I)) YMIN=YP(I)
      YL2=YP(I)+(XB1-XP(I))*TAN(WDMANG)
      IF(YL2.LT.YMAX) YMAX=YL2
      IF(YL2.LT.YP(I)) YMAX=YP(I)
      GO TO 320
  312 XL2=XP(I)+(YB2-YP(I))/TAN(WDMANG)
      IF(XL2.LT.XMAX) XMAX=XL2
      IF(XL2.LT.XP(I)) XMAX=XP(I)
      YL1=YP(I)+(XB1-XP(I))*TAN(WDPANG)
      IF(YL1.GT.YMIN) YMIN=YL1
      IF(YL1.GT.YP(I)) YMIN=YP(I)
      GO TO 320
  314 XL2=XP(I)+(YB1-YP(I))/TAN(WDPANG)
      IF(XL2.LT.XMAX) XMAX=XL2
      IF(XL2.LT.XP(I)) XMAX=XP(I)
      YL2=YP(I)+(XB1-XP(I))*TAN(WDMANG)
      IF(YL2.LT.YMAX) YMAX=YL2
      IF(YL2.LT.YP(I)) YMAX=YP(I)
      GO TO 320
  315 XL2=XP(I)+(YB2-YP(I))/TAN(WDMANG)
      IF(XL2.LT.XMAX) XMAX=XL2
      IF(XL2.LT.XP(I)) XMAX=XP(I)
      YL1=YP(I)+(XB1-XP(I))*TAN(WDPANG)
      IF(YL1.GT.YMIN) YMIN=YL1
      IF(YL1.GT.YP(I)) YMIN=YP(I)
      GO TO 320
  320 IF(XMIN.GT.XB2.OR.XMAX.LT.XB1.OR.YMIN.GT.YB2.OR.YMAX.LT.YB1)
     1 GO TO 600
      IF(XMIN.LT.XB1) XMIN=XB1
      IF(XMAX.GT.XB2) XMAX=XB2
      IF(YMIN.LT.YB1) YMIN=YB1
      IF(YMAX.GT.YB2) YMAX=YB2
C
C  DETERMINE THE RANGE OF RECEPTOR GRID ROW AND COLUMN NUMBERS (LXMAX,
C    LXMIN,LYMAX,LYMIN) CORRESPONDING TO XMAX, ETC. ABOVE -
C    LOOP (DO 500) THROUGH ALL OF THESE RECEPTORS.
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C
      LXMAX=(XMAX-XSWC)/GRID + 1.
      LXMIN= (XMIN-XSWC)/GRID + 1.
      LYMAX= (YMAX-YSWC)/GRID + 1.
      LYMIN= (YMIN-YSWC)/GRID + 1.
      DO 500 IX=LXMIN,LXMAX
      XI=IX
      XG= XSWC + (XI-0.5)*GRID
      XD= XG - XP(I) + 0.00001
      XDSQ=XD*XD
      DO 500 JY=LYMIN,LYMAX
      YJ=JY
      YG= YSWC + (YJ-0.5)*GRID
      YD= YG - YP(I) + 0.00001
C  DSQ= SQUARE OF SOURCE-RECEPTOR DISTANCE. IF SOURCE-RECEPTOR DISTANCE
C    IS GREATER THAN 60 KM., RECEPTOR IS SKIPPED.
      DSQ= XDSQ + YD*YD
      IF(DSQ.GT.3600.) GO TO 500
      DELTA= ATAN(XD/YD)
      IF(DELTA.LT.0.) DELTA = DELTA + 3.1415927
      IF(XD.LT.0.) DELTA = DELTA + 3.1415927
      DELTA= ABS(DELTA - WVEC)
      IF(DELTA.GT.3.1415927) DELTA= ABS(6.2831853 - DELTA)
C  IF THE CROSSWIND ANGLE (DELTA) EXCEEDS A LIMITING VALUE WHICH
C    DEPENDS ON STABILITY CLASS (ANGLIM), THE RECEPTOR IS SKIPPED.
C     10-MIN ANGLIM = 35,28,21,14,14,10.5,AND 7.0 DEG.
C             STAB. CLASSES A, B, C, DD, DN, E, AND F RESPECTIVELY
C     30-MIN ANGLIM= 50.4, 38.5, 25.9, 15.4, 15.4, 10.5, AND 7.0 DEG.
C     1-HOUR ANGLIM= 63.0, 49.7, 32.5, 18.9, 18.9, 11.9, AND 7.7 DEG.
C     3-HOUR ANGLIM= 76.3, 65.1, 45.5, 25.2, 25.2, 14.0, AND 9.1 DEG.
C
      IF(DELTA.GT.ANGLIM(ISC)) GO TO 500
C  DELTA IS THE ANGLE BETWEEN THE WIND VECTOR AND THE SOURCE-RECEPTOR
C    DIRECTION.  THE DOWNWIND DISTANCE USED IN THE GAUSSIAN PLUME
C    EQUATION IS=   DIST= SQRT(DSQ)*COS(DELTA).
      DIST=SQRT(DSQ)*COS(DELTA)
      IF(DIST.LT.0.002) GO TO 500
C
C  SUBROUTINE KYCAL RETURNS A COEFFICIENT (KYC) INTERPOLATED FROM THE
C    KY TABLE FOR THE APPROPRIATE DOWNWIND DISTANCE (DIST),
C    CROSSWIND ANGLE (DELTA), STABILITY CLASS, AND AVERAGING TIME.
C
      CALL KYCAL
      IF(DIST.LT.D80) GO TO 340
C  CALCULATE KZC ASSUMING TOTAL VERTICAL MIXING.
      KZC=TOTKZ
      GO TO 350
340   IF(DIST.LT.D47) GO TO 349
C  CALCULATE KZC ASSUMING PARTIAL VERTICAL MIXING.
      XDIST=DIST
      DIST=D47
      CALL KZCAL
      KZC=(D80-XDIST)*KZC/D8047 + (XDIST-D47)*TOTKZ/D8047
      GO TO 350
C  CALCULATE KZCAL ASSUMING NO VERTICAL MIXING EFFECTS.
349   CALL KZCAL
350   DO 370 K=1,NPOL
      IF(INPOL.EQ.2) MAQ= 2
      IF(INPOL.NE.2) MAQ= K
C
C  CALCULATE CONCENTRATION OF POLLUTANT K AT RECEPTOR IN COLUMN IX,
C    ROW JY OF THE RECEPTOR GRID DUE TO POINT SOURCE I.
      CHI= KZC*KYC*EP(I,MAQ)*UINV*DECAY(NDIST,K)
      IF(NCSOPT.EQ.0) GO TO 370
      CALL WORST(IX,JY,CHI)
      IF(NTOPT.GE.5) CONC(IX,JY,2)=CONC(IX,JY,2) + CHI
370   CONC(IX,JY,K)= CONC(IX,JY,K) + CHI*STCONV
500   CONTINUE
600   CONTINUE
C
C  KEY TO SWITCHES BELOW:
C
C   * IF LAST SCENARIO (ISCEN=NSCEN), OUTPUT (CALL OUTMOD) AND END.
C   * IF NOT LAST SCENARIO (ISCEN LESS THAN NSCEN), OUTPUT (CALL OUTMOD)
C       AND START THE NEXT SCENARIO (GO TO 100).
C   * IF LAST SCENARIO AND NWDOPT=2 OR 3, OUTPUT, BUT DON'T END UNTIL
C       ALL FOUR WIND DIRECTIONS HAVE BEEN RUN (IWDOPT=4).
C   * IF A 24 HR. SCENARIO (NTOPT=5), DON'T OUTPUT TILL ALL EIGHT 3 HR.
C       SEGMENTS HAVE BEEN RUN.
C   * IF A 24 HR. SCENARIC (NTOPT=6), DON'T OUTPUT TILL ALL 24 1 HR.
C       SEGMENTS HAVE BEEN RUN.
C   * IF A VARIABLE LENGTH SCENARIO (NTOPT=7), DON'T OUTPUT TILL THE
C       LAST SEGMENT (ISCEN=NSCEN) HAS BEEN RUN.
C
603   IF(NTOPT.GE.5) GO TO 620
      CALL OUTMOD
      IF(ISCEN.EQ.NSCEN) GO TO 630
      GO TO 100
620   IF(NCSOPT.GT.0) CALL WOROUT
      IF(ISCEN.LT.NSCEN) GO TO 100
      CALL OUTMOD
630   IF(NWDOPT.LE.1) GO TO 999
      IF(NTOPT.GE.7) GO TO 999
      IF(NWDOPT.LE.7.AND.IWDOPT.GE.4) GO TO 999
      IF(NWDOPT.EQ.8.AND.IWDOPT.GE.16) GO TO 999
      GO TO 100
999   IF(NMAX.GT.0) CALL MAXOUT
1005  FORMAT(1H1,'T.E.M. VERSION 8 - ',20A4/
     *        1H0,'SCENARIO ',I2,'  POINT SOURCE PLUME RISE CALCULATIONS.
     1  MIXING HEIGHT = ',F7.2,' M. IF MAX. HT. > ',F7.1,' M, SOURCE IS
     2NEGLECTED.'//' NUMBER   X (KM)   Y (KM)   E1 (G/S)  E2 (G/S)   HT
     3(M)  DIAM (M)  VEL (M/S)  TEMP (K)  DOMINANT INFLUENCE  MAX EFF SO
     4URCE HT (M)'/)
1010  FORMAT(1X,I4,4X,2(F7.2,2X),1X,2(F7.2,3X),1X,F6.2,3X,F6.3,4X,F7.3,
     1 3X,F7.2,8X,2A4,1X,A5,A5,2X,F7.1)
      STOP
      END
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$SET OWN LINEINFO STACK OPT=1 & Z   PH26*TEMV8(1).RISE...136774063515
       SUBROUTINE RISE
C
C   SUBROUTINE RISE CALCULATES PLUME RISE VIA ONE OF SIX EQUATIONS
C     (BRIGGS,1969). IF IRISE=1, DISTANCE DEPENDENT EFFECTIVE SOURCE
C     HEIGHT (ESH(1)) IS RETURNED. IF IRISE=2, MAXIMUM EFFECTIVE SOURCE
C     HEIGHT (ESH(2)) IS RETURNED. RISE IS CALLED ONCE PER SOURCE PER
C     SCENARIO WITH IRISE=2. IT IS CALLED WITH IRISE=1 WHENEVER THE
C     DOWNWIND DISTANCE (DIST) IS LESS THAN THE DISTANCE TO MAXIMUM
C     PLUME RISE (PEAK).
C
       COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TI(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D90,D47,D9047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTMU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUOY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
       REAL KY,KZ
       IDWN=1
       IF(IRISE.EQ.1) GO TO 300
       DWNWSH= 1.0
       IF(IBUOY.EQ.0) GO TO 205
       IF(EFF.GE.55.) GO TO 150
C
C   XS,CTB, AND CTMU ARE INDEPENDENT OF DISTANCE, AND ARE THEREFORE
C     CALCULATED ONCE PER SOURCE PER SCENARIO (WHEN IRISE=2).
       XS= 49.*EFF**0.625
       GO TO 160
150    XS=119.*EFF**0.4
160    CTB= 1.6*UINV*EFF**0.333333
       IF(ISC.GE.6) GO TO 170
C
C   PEAK PLUME RISE: BUOYANCY-DOMINATED PLUME, UNSTABLE AIR (A-D).
       DELTAH= CTB*XS**0.666667
       GO TO 250
C
C   PEAK PLUME RISE: BUOYANCY-DOMINATED PLUME, STABLE AIR (E,F).
170    DELTAH= 2.6*(EFF*UINV*TA(ISCEN)/(9.8*DTDZ(ISC-5)))**0.333333
       GO TO 250
205    IF(ISC.GE.6) GO TO 230
       CTMU= 1.89*(VP(IPS)*VP(IPS)*DP(IPS)*UINV/(VP(IPS)+3./UINV))**0.666
      1667
C
C   PEAK PLUME RISE: MOMENTUM-DOMINATED PLUME, UNSTABLE AIR (A-D).
       DELTAH= 3.0*VP(IPS)*DP(IPS)*UINV
       GO TO 250
C
C   PEAK PLUME RISE: MOMENTUM-DOMINATED PLUME, STABLE AIR (E,F).
230    DELTAH= 1.5*(0.5*VP(IPS)*DP(IPS))**0.666667*UINV**0.333333
      1 *(TA(ISCEN)/(DTDZ(ISC-5)*9.8))**0.166667
250    IF(NSTDWN.EQ.1) GO TO 270
       IF(VP(IPS)*UINV.GT.1.5) GO TO 270
       CDELH= 2.0*(1.5 - VP(IPS)*UINV)*DP(IPS)
       IDWN=3
       IF(CDELH.GE.DELTAH) GO TO 260
       DWNWSH= (DELTAH-CDELH)/DELTAH
      GO TO 270
260   DWNWSH= 0.
270   ESH(2)= HP(IPS) + DELTAH*DWNWSH
300   IF(IBUOY.EQ.0) GO TO 500
C
C  DISTANCE-DEPENDENT PLUME RISE: BUOYANCY-DOMINATED PLUME,
C    ANY STABILITY (A-F).
      ESH(1)= DWNWSH*CTB*(DIST*1000.)**0.666667 + HP(IPS)
      IF(ESH(1).GT.ESH(2)) ESH(1)=ESH(2)
      RETURN
C
C  DISTANCE-DEPENDENT PLUME RISE: MOMENTUM-DOMINATED PLUME,
C    UNSTABLE AIR (A-D).
500   ESH(1)= DWNWSH*CTMU*(DIST*1000.)**0.333333 + HP(IPS)
      IF(ESH(1).GT.ESH(2)) ESH(1)=ESH(2)
      RETURN
C
C  THERE IS NO DISTANCE-DEPENDENT PLUME RISE GIVEN FOR A
C    MOMENTUM-DOMINATED PLUME IN STABLE AIR. DISTANCE TO MAXIMUM PLUME
C    RISE FOR THIS SITUATION IS SET EQUAL TO ZERO IN THE MAIN PROGRAM,
C    SO THE MAXIMUM HEIGHT, ESH(2), IS USED AT ALL DISTANCES.
      END
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$SET OWN LINEINFO STACK OPT=1 $ I    PM26*TEMV8(1).KZCAL,,,137117063515

      SUBROUTINE K7CAL
C
C  SUBROUTINE KZCAL CALCULATES KZC, A FACTOR REPRESENTING THE VERTICAL
C    DISPERSION OF THE PLUME IN THE POINT SOURCE CONCENTRATION EQUATION.
C    IF DOWNWIND DISTANCE (DIST) IS LESS THAN 2 KM., KZC IS COMPUTED
C    EXPLICITLY. ALL PLUME RISE IS ASSUMED TO TAKE PLACE IN THIS
C    DISTANCE RANGE. IF DOWNWIND DISTANCE IS 2 KM. OR MORE, KZC IS
C    DETERMINED BY LINEAR INTERPOLATION IN THE KZ DATA TABLE, ASSUMING
C    A LEVEL (NOT RISING) PLUME.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DFCAY(20,2),TT(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTMU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,ISD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
      DIMENSION KD(59),VDINT(19)
      REAL KY,KZ,K7C
      DATA KD/0,1,2,3,4,5,6,7,7,8,8,9,9,10,10,10,11,11,11,12,
     1 12,12,13,13,13,13,14,14,14,14,15,15,15,15,15,16,16,16,16,16,
     2 17,17,17,17,17,17,18,18,18,18,18,18,19,19,19,19,19,19,19/
      DATA VDINT/1.,1.,1.,1.,1.,1.,.5,.5,.5,.333333,.333333,.333333,
     1 .25,.25,.2,.2,.166667,.166667,.142857/
      IF(DIST.LT.2.) GO TO 200
C
C  CALCULATE KZC BY INTERPOLATION IN KZ DATA TABLE.
C    INTERPOLATION FACTORS: NDIST,FDIST FOR DOWNWIND DISTANCE
C                                          (COMPUTED IN KYCAL),
C                           NSH,FSH FOR EFFECTIVE SOURCE HEIGHT
C                                      (COMPUTED IN MAIN PROGRAM).
C
      ND=DIST
      NDIST=KD(ND)
      FDIST=(DIST-DLIM(NDIST))*VDINT(NDIST)
      KZC = (1.-FDIST)*(KZ(NDIST,NSH,ISC)*(1.-FSH) +
     1      KZ(NDIST,NSH+1,ISC)*FSH)
      KZC = (FDIST)*(KZ(NDIST+1,NSH,ISC)*(1.-FSH) +
     1      KZ(NDIST+1,NSH+1,ISC)*FSH) + KZC
      RETURN
200   IF(DIST.GE.PEAK) GO TO 300
C
C  CALL SUBROUTINE RISE FOR EFFECTIVE SOURCE HEIGHT AT DOWNWIND
C    DISTANCE = DIST, LESS THAN DISTANCE TO MAXIMUM HEIGHT (PEAK).
      CALL RISE
      HGT= ESH(1)
      GO TO 310
C
C  USE MAXIMUM EFFECTIVE SOURCE HEIGHT, SINCE DOWNWIND DISTANCE
C    EXCEEDS THE DISTANCE TO MAXIMUM HEIGHT.
300   HGT= ESH(2)
310   JD=2
      IF(DIST.LT.0.5) JD=1
      SIGZ= AX(ISC,JD)*(1000.*DIST)**BX(ISC,JD)
      KZC=(318.31/SIGZ)*EXP(-0.5*HGT*HGT/(SIGZ*SIGZ))
      RETURN
      END
```

```
$SET OWN LINEINFO STACK OPT=1 $ %   PM26*TEM/3(1).WORST,,,140024063515
      SUBROUTINE WORST(I,J,CHI)
C
C  SUBROUTINE WORST DETERMINES THE FIVE POINT SOURCES CONTRIBUTING THE
C    MOST TO THE TOTAL CONCENTRATION AT EACH RECEPTOR. SOURCE
C    IDENTIFICATIONS AND CONTRIBUTIONS ARE STORED IN NWORST AND CWORST
C    RESPECTIVELY, FOR OUTPUT BY SUBROUTINE WOROUT.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),ILAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(3),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTAU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
      IF(CHI.LE.CWORST(I,J,5)) RETURN
      IF(CHI.GT.CWORST(I,J,4)) GO TO 205
      CWORST(I,J,5)= CHI
      NWORST(I,J,5)= IPS
      RETURN
205   IF(CHI.GT.CWORST(I,J,3)) GO TO 210
      NW=1
      GO TO 225
210   IF(CHI.GT.CWORST(I,J,2)) GO TO 215
      NW=2
      GO TO 225
215   IF(CHI.GT.CWORST(I,J,1)) GO TO 220
      NW=3
      GO TO 225
220   NW=4
225   DO 250 IW=1,NW
      CWORST(I,J,6-IW)= CWORST(I,J,5-IW)
250   NWORST(I,J,6-IW)= NWORST(I,J,5-IW)
      CWORST(I,J,5-NW)= CHI
      NWORST(I,J,5-NW)= IPS
      RETURN
      END
```

```
$SET OWN LINEINFO STACK OPT=1 $ %   PM26*TEMV8(1).SCENMX,,,140112063515

      SUBROUTINE SCENMX
C
C  SUBROUTINE SCENMX LOCATES AND STORES THE COORDINATES AND
C    CONCENTRATIONS AT THE RECEPTOR GRID POINTS RECORDING THE
C    HIGHEST CONCENTRATIONS OF EACH POLLUTANT IN EACH SCENARIO.
C    STORED VALUES ARE OUTPUT BY SUBROUTINE MAXOUT AT THE END
C    OF THE RUN.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),ILAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTAU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
      IF(NFOPT.LT.5) GO TO 120
      I= 1
      GO TO 130
120   I= ISCEN
130   IF(NWDOPT.LE.1) GO TO 140
      J= IWDOPT
      GO TO 150
140   J= 1
150   DO 400 K=1,NPOL
      Z= 0.
      DO 350 NX=1,LX
      DO 350 NY=1,LY
      IF(CONC(NX,NY,K).LT.Z) GO TO 350
      Z= CONC(NX,NY,K)
      ZX=NX
      ZY=NY
350   CONTINUE
      ZMX(I,J,K)= Z
      XMX(I,J,K)= XSWC + (ZX - 0.5)*GRID
      YMX(I,J,K)= YSWC + (ZY - 0.5)*GRID
400   CONTINUE
      RETURN
      END
```

```
$SET OWN LINEINFO STACK OPT=1 $ 1    PM26*TEMV8(1).KYCAL...160137110115
      SUBROUTINE KYCAL
C
C  SUBROUTINE KYCAL CALCULATES KYC, A FACTOR REPRESENTING THE CROSSWIND
C    DISPERSION OF THE PLUME IN THE POINT SOURCE CONCENTRATION EQUATION.
C    IF DOWNWIND DISTANCE (DIST) IS LESS THAN 2 KM., KYC IS COMPUTED
C    EXPLICITLY. IF DOWNWIND DISTANCE IS 2 KM. OR MORE, KYC IS
C    DETERMINED BY LINEAR INTERPOLATION IN THE KY DATA TABLE.
C      THE NDIST AND FDIST INTERPOLATION FACTORS CALCULATED HERE ARE
C      ALSO USED IN SUBROUTINE KZCAL AND IN THE MAIN PROGRAM.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TI(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTMU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTOWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IOWN
      DIMENSION CX(7),DX(7),KD(59),VDINT(19)
      REAL KY,KZ,KYC
      DATA CX/.495,.310,.197,.122,.122,.0934,.0625/
      DATA DX/.873,.897,.908,.916,.916,.912,.911/
      DATA KD/0,1,2,3,4,5,6,7,7,8,8,9,9,10,10,10,11,11,11,12,
     1 12,12,13,13,13,13,14,14,14,14,15,15,15,15,15,16,16,16,16,16,
     2 17,17,17,17,17,17,18,18,18,18,18,18,19,19,19,19,19,19,19/
      DATA VDINT/1.,1.,1.,1.,1.,1.,.5,.5,.5,.333333,.333333,.333333,
     1 .25,.25,.2,.2,.166667,.166667,.142857/
      IF(DIST.LT.2.) GO TO 800
C
C  CALCULATE KYC BY INTERPOLATION IN KY DATA TABLE.
C    INTERPOLATION FACTORS: NDIST,FDIST FOR DOWNWIND DISTANCE,
C                           NANG,FANG FOR CROSSWIND ANGLE.
C
      ND=DIST
      NDIST= KD(ND)
      FDIST= (DIST - DLIM(NDIST))*VDINT(NDIST)
600   NANG= DELTA/DEL(ISC) + 1
      TN= NANG - 1
      FANG=  (DELTA-DEL(ISC)*TN)/DEL(ISC)
      TKY1=(KY(NDIST,NANG,ISC)*(1.-FANG) + KY(NDIST,NANG+1,ISC)*FANG)
     1 *(1.-FDIST)
      TKY2= (KY(NDIST+1,NANG,ISC)*(1.-FANG) + KY(NDIST+1,NANG+1,ISC)
     1 *FANG)*FDIST
      KYC = TKY1 + TKY2
      RETURN
C
C  CALCULATE KYC EXPLICITLY.
C    WHY= CROSSWIND DISTANCE IN METERS, = DOWNWIND DISTANCE* TAN(DELTA)
C
800   WHY= DIST*TAN(DELTA)*1000.
      CSTIME = (TBASE/ST(NTOPT))**PSC(ISC)
      SIGY= CX(ISC)*(DIST*1000.)**DX(ISC)/CSTIME
      KYC = (1000./SIGY)*EXP(-0.5*WHY*WHY/(SIGY*SIGY))
C  NDIST IS SET TO ONE HERE SOLELY FOR USE IN THE POLLUTANT DECAY TERM
C    IN THE MAIN PROGRAM.
      NDIST=1
      RETURN
      END
```

```
$SET OWN LINEINFO STACK OPT=1 $ Z    PM26*TEMV3(1).INMOD,,,166261110115
      SUBROUTINE INMOD
C
C  SUBROUTINE INMOD READS IN ALL INPUTS TO THE MODEL, AND PRINTS OUT
C    LISTS OF THE CONTROL PARAMETERS, SCENARIO PARAMETERS, AND
C    SOURCE DATA FOR REFERENCE. INMOD ALSO PROCESSES THE INPUT BEFORE
C    TRANSMITTING IT TO THE MAIN PROGRAM FOR EACH SCENARIO, AND PRINTS
C    WARNING MESSAGES AND INSERTS DEFAULT VALUES WHERE NECESSARY.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTAU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
      DIMENSION NAME(4),POLLAB(3),WDINC(6),SUMAQ(2),SUMPQ(2)
      REAL KY,KZ
      DATA NAME/4H    ,4H    ,4H    ,4H    /
      DATA POLLAB/3H 1 ,3H 2 ,3H1&2/
      DATA WDINC/1.5707963,0.7853982,0.5235988,0.2617994,
     1           0.1745329,0.08726646/
      IF(INDEX.NE.0) GO TO 300
C
C  R E A D   A L L   I N P U T   D A T A .
C
C  READ FIRST CONTROL PARAMETER CARD (TITLE).
C
      READ(IRD,800)TT
C
C  READ SECOND CONTROL PARAMETER CARD (OPTIONS).
C
C     NTOPT  = AVERAGING TIME OPTION.
C     NWDOPT = WIND DIRECTION INPUT OPTION.
C     NWSOPT = WIND SPEED INPUT OPTION.
C     NSCEN  = NUMBER OF SCENARIOS.
C     NPOL   = NUMBER OF POLLUTANTS.
C     NLIST  = OUTPUT OPTION: LIST.
C     NARRAY = OUTPUT OPTION: ARRAY MAP.
C     NPUNCH = OUTPUT OPTION: PUNCH.
C     NCSOPT = OUTPUT OPTION: CULPABILITY LIST.
C     NMAX   = OUTPUT OPTION: MAXIMUM CONCENTRATION FOR EACH SCENARIO.
C     NSTDWN = STACK-TIP DOWNWASH OPTION
C     INTPUN = OUTPUT PUNCH INTERVAL.
C     NSRCOP = GRID AND SOURCE INPUT OPION
C     NPRINT = POINT SOURCE PRINT OPTION
C      INPTSC = 2, THEN POINT SOURCE DATA IS READ FROM UNIT IDSK
C      INPTSC = 1, THEN POINT SOURCE DATA IS READ FROM UNIT IRD
C
      READ(IRD,805)NTOPT,NWDOPT,NWSOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,
     1 NCSOPT,NMAX,NSTDWN,INTPUN,NSRCOP,NPRINT,INPTSC
      IF(NSRCOP.EQ.2) NPOL=1
      IF(NPOL.EQ.3) NCSOPT=0
      IF(NSRCOP.EQ.0) NSRCOP=1
      IF(NTOPT.EQ.0) NTOPT=1
      IF(NSCEN.EQ.0) NSCEN=1
      IF(NWDOPT.GE.2) NLIST=0
      IF(NWDOPT.GE.2) NPUNCH=0
      IF(NSCEN.GT.6)  NPUNCH=0
      IF(INTPUN.EQ.0) INTPUN=1
      IF(NCSOPT.GT.1) NCSOPT=0
      IF(INPTSC.EQ.0) INPTSC=1
C
C   READ THIRD CONTROL PARAMETER CARD (GRID, DTDZ)
C
C     XRSWC,YRSWC = COORDINATES OF SOUTHWEST CORNER OF RECEPTOR GRID.
C     LX          = NUMBER OF COLUMNS IN RECEPTOR GRID.
C     LY          = NUMBER OF ROWS IN RECEPTOR GRID.
C     GRID        = SPACING BETWEEN ROWS AND COLUMNS OF RECEPTOR GRID.
C
C     DTDZ(1&2) = VERTICAL POTENTIAL TEMPERATURE GRADIENT
C                      FOR STABILITY CLASSES E & F.
C
      READ(IRD,810)XRSWC,YRSWC,LX,LY,GRID,DTDZ(1),DTDZ(2)
      NCARDS=((LX+1)/INTPUN)*((LY+1)/INTPUN)*NSCEN
      IF(LX.GT.50) LX=25
      IF(LY.GT.50) LY=25
      IF(LX.EQ.0) LX=1
      IF(LY.EQ.0) LY=1
      IF(NTOPT.EQ.5) NCARDS= NCARDS/8
      IF(NTOPT.EQ.6) NCARDS= NCARDS/24
      IF(NTOPT.GT.6) NCARDS= NCARDS/NSCEN
      IF(NCARDS.LT 10000) GO TO 105
      IF(NPUNCH.GT.0) WRITE(IWR,100)
100   FORMAT(1H1,'RUN REQUESTED WOULD PRODUCE OVER 10000 PUNCHED CARDS.'
     1/' OUTPUT OPTION WAS CHANGED TO ELIMINATE PUNCHED OUTPUT.')
      NPUNCH= 0
105   IF(NLIST.EQ.0.OR.NWDOPT.LE.1.OR.(NSCEN*LX*4).LE.600) GO TO 115
      NLIST= 0
      WRITE(IWR,110)
110   FORMAT(1H1,'RUN REQUESTED WOULD PRODUCE OVER 600 PAGES OF OUTPUT.'
     1/' OUTPUT OPTION WAS CHANGED TO OPTION 5 TO REDUCE AMOUNT OF OUTPU
     2T')
115   CONTINUE
      IF(NCSOPT.LT.1.OR.(LX.LE.25.AND.LY.LE.25)) GO TO 120
      WRITE(IWR,118)LX,LY
118   FORMAT(1H1,'*** ERROR - NUMBER OF COLUMNS OR ROWS IN RECEPTOR GRID
     1'/14X,'MAY NOT EXCEED 25 IF CONTROL LIST OPTION IS USED.'//14X,
     2'CONTROL LIST WAS REQUESTED WITH ',I2,' COLUMNS AND ',I2,' ROWS.')
      STOP
120   IF(NSRCOP.NE.2) GO TO 125
      XRSWC= XRSWC*0.0003048
      YRSWC= YRSWC*0.0003048
      GRID= GRID*0.0003048
C     SHIFT THE RECEPTOR GRID TO THE COMPUTATION GRID.
125   XSWC= XRSWC - 0.5*GRID
      YSWC= YRSWC - 0.5*GRID
C
C       THE VALUES GIVEN BELOW FOR DTDZ(1 AND 2) ARE FOR
C            GENERAL USE.  WHEN MODELING SOURCES LOCATED IN
C            TEXAS, THE TACB WILL USE DTDZ(1)=0.018 FOR CLASS E
C            AND DTDZ(2)=0.025 FOR CLASS F.
C
130   IF(DTDZ(1).LT.0.00001) DTDZ(1)=0.020
      IF(DTDZ(2).LT.0.00001) DTDZ(2)=0.035
C  IF GRID IS ZERO, SWITCH ON AUTOMATIC GRID OPTION.
      IGRID=0
      IF(GRID.LT.1.0E-5) IGRID=1
      IF(IGRID.EQ.1.AND.NTOPT.GE.5) WRITE(IWR,965)
      IF(IGRID.EQ.1.AND.NTOPT.GE.5) STOP
C
```

```
C   READ FOURTH CONTROL PARAMETER CARD (AREA SOURCE SCALING,CALIBRATION).
C
C     ASCALE(1&2) = AREA SOURCE EMISSION SCALING FACTORS
C                       FOR EACH POLLUTANT.
C     A(1&2)      = CONCENTRATION CALIBRATION FACTOR (INTERCEPT)
C                       FOR EACH POLLUTANT.
C     B(1&2)      = CONCENTRATION CALIBRATION FACTOR (SLOPE)
C                       FOR EACH POLLUTANT.
C
      READ(IRD,815)ASCALE,A,B
      IF(NTOPT.EQ.5) NSCEN= 5
      IF(NTOPT.EQ.6) NSCEN=24
C
C   READ POLLUTANT AND CALIBRATION LABELS
C
      READ(IRD,817)(POLNAM(I,1),I=1,3),(CALNAM(I,1),I=1,7),
     1             (POLNAM(I,2),I=1,3),(CALNAM(I,2),I=1,7)
C
C
C   READ ONE TO 24 SCENARIO CARDS.
C
C     NSC         = STABILITY CLASS NUMBER.
C     NWS         = WIND SPEED CLASS NUMBER.
C     NWD         = WIND SECTOR NUMBER.
C     WS          = WIND SPEED (M/S).
C     WD          = WIND DIRECTION (DEGREES).
C     TA          = AMBIENT TEMPERATURE (DEGREES CELSIUS).
C     HALF(1&2) = DECAY HALF-LIFE OF EACH POLLUTANT (HOURS).
C     PEN         = INVERSION PENETRATION FACTOR.
C     HMIX        = MIXING HEIGHT (METERS).
C
      DO 150 IS=1,NSCEN
      READ(IRD,820)NSC(IS),NWS(IS),NWD(IS),WS(IS),WD(IS),TA(IS),
     1 HALF(IS,1),HALF(IS,2),PEN(IS),HMIX(IS)
      IF(PEN(IS).LT.1.0) PEN(IS)=2.0
      IF(HALF(IS,1).LT.1.0E-5) HALF(IS,1)=999.99
      IF(HALF(IS,2).LT.1.0E-5) HALF(IS,2)=999.99
      IF(HMIX(IS).LT.1.0E-5) HMIX(IS)= 9999.9
150   CONTINUE
C
C   PRINT ALL CONTROL PARAMETERS AND SCENARIO PARAMETERS ON ONE PAGE.
C
      WRITE(IWR,900)TT
      WRITE(IWR,902)
      WRITE(IWR,904)
      WRITE(IWR,906)NWSOPT
      WRITE(IWR,908)
      WRITE(IWR,910)NTOPT
      WRITE(IWR,912)NSCEN
      WRITE(IWR,914)POLLAB(NPOL),DTDZ(1)
      WRITE(IWR,916)DTDZ(2),INTPUN
      IF(NSTDWN.EQ.0) WRITE(IWR,915)
      IF(NSTDWN.EQ.1) WRITE(IWR,917)
      WRITE(IWR,918)NWDOPT,NSRCOP
      IF(GRID.GE.1.0E-5) WRITE(IWR,919)LX,LY,GRID,XRSWC,YRSWC
      IF(GRID.LT.1.0E-5) WRITE(IWR,920)
      WRITE(IWR,921)ASCALE
      WRITE(IWR,922)A(1),B(1),A(2),B(2),(POLNAM(I,1),I=1,3),
     1 (CALNAM(I,1),I=1,7),(POLNAM(I,2),I=1,3),(CALNAM(I,2),I=1,7)
      WRITE(IWR,924)
      IF(NLIST.GT.0) WRITE(IWR,926)
      IF(NARRAY.EQ.1) WRITE(IWR,927)
      IF(NARRAY.EQ.2) WRITE(IWR,928)
      IF(NARRAY.EQ.3) WRITE(IWR,929)
      IF(NPUNCH.GT.0) WRITE(IWR,930)
      IF(NCSOPT.GT.0) WRITE(IWR,931)
      IF(NMAX.GT.0) WRITE(IWR,932)
      WRITE(IWR,934)TT
      WRITE(IWR,935)
      WRITE(IWR,936)
      WRITE(IWR,937)
      DO 160 IS=1,NSCEN
      KS=NSC(IS)
      IF(NWSOPT.EQ.0) NWS(IS)=99999
      IF(NWSOPT.GT.0) WS(IS)=1000000.
      IF(NWDOPT.EQ.0.OR.NWDOPT.GE.2) NWD(IS)=99999
      IF(NWDOPT.EQ.1.OR.NWDOPT.GE.8) WD(IS)=1000000.
155   WRITE(IWR,938)IS,SCLAB(KS),NWS(IS),WS(IS),NWD(IS),WD(IS),TA(IS),
     1 (HALF(IS,K),K=1,2),PEN(IS),HMIX(IS)
      IF(NWSOPT.EQ.0) GO TO 157
      KW=NWS(IS)
      WS(IS)=CWS(KW)
157    WD(IS)= WD(IS)*3.14159265/180.
      TA(IS)= TA(IS) + 273.15
      DO 158 K=1,2
158   HALF(IS,K)= HALF(IS,K)*3600.
C
C  FOR EACH SCENARIO, CALCULATE THE CRITICAL DOWNWIND DISTANCES
C     AT WHICH VERTICAL MIXING IMPENDS (DCRIT(IS,1)) AND IS COMPLETE
C     (DCRIT(IS,2)).
      JSC=NSC(IS)
      JD=3
      IF(AX(JSC,2)*5000.**BX(JSC,2).GT.0.47*HMIX(IS)) JD=2
      IF(AX(JSC,1)*500.**BX(JSC,1).GT.0.47*HMIX(IS))  JD=1
      DCR(IS,1)=0.001*(0.47*HMIX(IS)/AX(JSC,JD))**(1./BX(JSC,JD))
      DCR(IS,2)= DCR(IS,1)*2.
160   CONTINUE
      WRITE(IWR,939)TT
      SUMAQ(1)=0.0
      SUMAQ(2)=0.0
      NAS=1
C
C  READ UP TO 50 AREA SOURCE CARDS.
C
C     XA,YA    = COORDINATES OF SOUTHWEST CORNER OF AREA SOURCE (KM).
C     SIZE     = LENGTH OF A SIDE OF AREA SOURCE (M).
C     EA(1&2) = EMISSION RATES OF 2 POLLUTANTS (G/S).
C
C
170   READ(IRD,825)XA(NAS),YA(NAS),SIZE(NAS),EA(NAS,1),EA(NAS,2)
      IF(SIZE(NAS).LT.1.0E-4) GO TO 180
      SIZE(NAS)=SIZE(NAS)*0.001
      DO 175 K=1,2
      EA(NAS,K)= EA(NAS,K)*ASCALE(K)
175   SUMAQ(K)=SUMAQ(K)+EA(NAS,K)
C
C  PRINT AREA SOURCE LIST.
      WRITE(IWR,940)NAS,XA(NAS),YA(NAS),SIZE(NAS),EA(NAS,1),EA(NAS,2)
      IF(NAS/50*50.EQ.NAS) WRITE(IWR,935)TT
      NAS=NAS+1
      GO TO 170
180   NAS=NAS-1
      WRITE(IWR,970) SUMAQ(1),SUMAQ(2)
      WRITE(IWR,945)TT
      NPS=1
      SUMPQ(1)=0.0
      SUMPQ(2)=0.0
185   IF(NSRCOP.NE.1) GO TO 187
```

```
C
C   READ UP TO 300 POINT SOURCES, NSRCOP=1 FORMAT
C
C     XP,YP    = COORDINATES OF POINT SOURCE (KM).
C     EP(1&2)  = EMISSION RATES OF 2 POLLUTANTS (G/S).
C     HP       = SOURCE HEIGHT (M).
C     DP       = INSIDE DIAMETER (M).
C     VP       = VELOCITY (M/S).
C     TP       = TEMPERATURE (DEGREES CELSIUS).
C     NAME     = IDENTIFICATION.
C
       IF(INPTSC.EQ.2)READ(IDSK,830)XP(NPS),YP(NPS),EP(NPS,1),EP(NPS,2),
     1 HP(NPS),DP(NPS),VP(NPS),TP(NPS),NAME(1),NAME(2)
       IF(INPTSC.EQ.1) READ(IRD,830)XP(NPS),YP(NPS),EP(NPS,1),EP(NPS,2),
     1 HP(NPS),DP(NPS),VP(NPS),TP(NPS),NAME(1),NAME(2)
       IF(HP(NPS)+DP(NPS)+VP(NPS)+TP(NPS).LT.1.0E-4) GO TO 200
       IF(DP(NPS).LE.0.0) WRITE(IWR,960)
       IF(DP(NPS).LE.0.0) STOP
       TP(NPS)= TP(NPS) + 273.15
       GO TO 199
C
C   READ UP TO 300 POINT SOURCES, NSRCOP=2 FORMAT
C
C     NAME     = IDENTIFICATION.
C     XP,YP    = COORDINATES OF POINT SOURCE (FT).
C     EP(1)    = EMISSION RATE OF 1 POLLUTANT (LB/HR).
C     HP       = SOURCE HEIGHT (FT).
C     DP       = INSIDE DIAMETER (FT).
C     VP       = VELOCITY (FT/S).
C     ACFM     = STACK FLOW (CU FT/MIN).
C     TP       = TEMPERATURE (DEGREES FAHRENHEIT).
C
187    IF(NSRCOP.NE.2) GO TO 190
       IF(INPTSC.EQ.2)READ(IDSK,833)NAME(1),XP(NPS),YP(NPS),EP(NPS,1),
     1 HP(NPS), DP(NPS), VP(NPS),ACFM,TP(NPS)
       IF(INPTSC.EQ.1) READ(IRD,833)NAME(1),XP(NPS),YP(NPS),EP(NPS,1),
     1 HP(NPS), DP(NPS), VP(NPS),ACFM,TP(NPS)
       IF(HP(NPS)+DP(NPS)+VP(NPS)+TP(NPS).LT.1.0E-4) GO TO 200
       IF(DP(NPS).LE.0.0) WRITE(IWR,960)
       IF(DP(NPS).LE.0.0) STOP
       IF(VP(NPS).GT.1.0E-5.OR.ACFM.LT.1.0E-5) GO TO 188
       VP(NPS)= ACFM/(47.1239*DP(NPS)*DP(NPS))
188    VP(NPS)= VP(NPS)*0.3048
       HP(NPS)=HP(NPS)*0.3048
       DP(NPS)=DP(NPS)*0.3048
       XP(NPS)=XP(NPS)*0.0003048
       YP(NPS)=YP(NPS)*0.0003048
       TP(NPS)=273.15 + (TP(NPS)-32.)*5./9.
       EP(NPS,1)=EP(NPS,1)*0.125997
       GO TO 199
C
C   READ UP TO 300 POINT SOURCES, NSCROP=3 FORMAT
C
C     XP,YP    = COORDINATES OF POINT SOURCE (KM).
C     EP(1&2)  = EMISSION RATES OF 2 POLLUTANTS (LB/HR).
C     HP       = SOURCE HEIGHT (FT).
C     DP       = INSIDE DIAMETER (FT).
C     VP       = VELOCITY (FT/S).
C     TP       = TEMPERATURE (DEGREES FAHRENHEIT)
C     NAME     = IDENTIFICATION
C
  190 IF(INPTSC.EQ.2)READ(IDSK,835)XP(NPS),YP(NPS),EP(NPS,1),EP(NPS,2),
     1 HP(NPS),DP(NPS),VP(NPS),TP(NPS),ACFM,NAME
       IF(INPTSC.EQ.1)READ(IRD,835)XP(NPS),YP(NPS),EP(NPS,1),EP(NPS,2),
     1 HP(NPS),DP(NPS),VP(NPS),TP(NPS),ACFM,NAME
      IF(HP(NPS)+DP(NPS)+VP(NPS)+TP(NPS).LT.1.0E-4) GO TO 200
      IF(DP(NPS).LE.0.0) WRITE(IWR,960)
      IF(DP(NPS).LE.0.0) STOP
      IF(VP(NPS).LT.1.0E-5.AND.ACFM.GT.1.0E-5)
     1           VP(NPS)= ACFM/(47.1239*DP(NPS)*DP(NPS))
      VP(NPS)= VP(NPS)*0.3048
      HP(NPS)= HP(NPS)*0.3048
      DP(NPS)= DP(NPS)*0.3048
      TP(NPS)= 273.15 + (TP(NPS)-32.)*0.555556
      EP(NPS,1)= EP(NPS,1)*0.125997
      EP(NPS,2)= EP(NPS,2)*0.125997
C
C  PRINT POINT SOURCE LIST
199   WRITE(IWR,950)NPS,XP(NPS),YP(NPS),EP(NPS,1),EP(NPS,2),
     1 HP(NPS),DP(NPS),VP(NPS),TP(NPS),NAME
      IF(NPS/50*50.EQ.NPS) WRITE(IWR,945)TT
      SUMPQ(1)=SUMPQ(1)+EP(NPS,1)
      SUMPQ(2)=SUMPQ(2)+EP(NPS,2)
      NPS=NPS+1
      GO TO 185
200   NPS= NPS-1
      WRITE(IWR,975)SUMPQ(1),SUMPQ(2)
      IWDOPT= 0
      INPOL= NPOL
C  CONVERT NPOL FROM POLLUTANTS-USED CODE TO NUMBER OF POLLUTANTS USED.
      IF(NPOL.GT.1) NPOL= NPOL-1
      ISCEN=0
      RETURN
C
C
C  P R E P A R E   S C E N A R I O   I N F O R M A T I O N .
C
300   IF(NWDOPT.LE.1) GO TO 350
      IF(ISCEN.EQ.0.OR.IWDOPT.GE.4) GO TO 320
      IWDOPT= IWDOPT + 1  .
      WD(ISCEN)= WD(ISCEN) + WDINC(NWDOPT-1)
      IF(WD(ISCEN).GE.6.2831853) WD(ISCEN)=WD(ISCEN) - 6.2831853
      GO TO 353
320   ISCEN= ISCEN + 1
      IWDOPT= 1
      GO TO 353
350   ISCEN= ISCEN + 1
353   ISC=NSC(ISCEN)
      IWS=NWS(ISCEN)
      IWD=NWD(ISCEN)
      D47= DCR(ISCEN,1)
      D80= DCR(ISCEN,2)
      D8047= D80 - D47
      IF(NCSOPT.EQ.0) GO TO 400
      DO 380 I=1,25
      DO 380 J=1,25
      DO 380 K=1,5
      NWORST(I,J,K)=0
380   CWORST(I,J,K)=0.
400   RETURN
C
C  800'S ARE INPUT FORMATS, 900'S ARE OUTPUT FORMATS.
800   FORMAT(20A4)
 805  FORMAT(15I3)
810   FORMAT(2F10.0,2I10,3F10.0)
815   FORMAT(6F10.0)
817   FORMAT(3A4,7A4,3A4,7A4)
820   FORMAT(2X,I1,2X,I1,2X,I2,7F10.0)
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825    FORMAT(F6.2,F7.2,F7.0,2F8.0)                                         00018790
830    FORMAT(F6.2,F7.2,7X,2F8.0,F7.0,F5.0,2F7.0,6X,2A4)                    00018800
833    FORMAT(A4,1X,7F10.0,F5.0)                                            00018810
835    FORMAT(2F8.0,3F7.0,F6.0,3F7.0,4A4)                                   00018820
900    FORMAT(1H1,45X,'T E X A S   E P I S O D I C   M O D E L',32X,       00018830
      1 'VERSION 8 (P-G)'//10X,'CONTROL PARAMETERS:  ',20A4/1X,131('-'))   00018840
902    FORMAT(1H ,'AVERAGING TIME OPTION (NTOPT):',24X,'WIND DIRECTION OP 00018850
      1TIONS (NWDOPT):',11X,'WIND SPEED OPTIONS (NWSOPT):'//' OPTION 1: B 00018860
      2ASIC AVERAGING TIME OF 10 MINUTES',10X,'OPTION 0: WIND DIRECTION I 00018870
      3N DEGREES          OPTION 0: WIND SPEED IN METERS PER'/' OPTION 2: RE 00018880
      4SULTS CONVERTED TO 30 MIN AVERAGING TIME',14X,'SPECIFIED FOR EACH  00018890
      5SCENARIO',16X,'SECOND SPECIFIED FOR')                               00018900
904    FORMAT(' OPTION 3: RESULTS CONVERTED TO 1 HOUR AVERAGING TIME  OPT 00018910
      1ION 1: WIND SECTOR NUMBER SPECIFIED',17X,'EACH SCENARIO'/' OPTION  00018920
      24: RESULTS CONVERTED TO 3 HOUR AVERAGING TIME',14X,'FOR EACH SCENA 00018930
      3RIO',14X,'OPTION 1: WIND SPEED CLASS NUMBER'/' OPTION 5: 24 HOUR A 00018940
      4VERAGING TIME: 8 3-HOUR',67X,'SPECIFIED FOR'/13X, 'SCENARIOS ARE A 00018950
      5VERAGED.',19X,'OPTIONS 2-7 ARE SIMILAR. FOR EACH, THE',17X,'EACH S 00018960
      6CENARIO')                                                           00018970

906    FORMAT(' OPTION 6: 24 HOUR AVERAGING TIME: 24 1-HOUR',11X,'WIND DI 00018980
      1RECTION IS SPECIFIED IN DEGREES.'/13X,'SCENARIOS ARE AVERAGED.',   00018990
      2 19X,'AND 4 ACTUAL SCENARIOS ARE GENERATED FOR   OPTION ',I1,' HAS 00019000
      3 BEEN SELECTED.'/' OPTION 7: 1 TO 24 SCENARIOS WITH THE BASIC AVER 00019010
      4AGING  EACH SCENARIO CARD. FOR EACH OF THESE 4     ',34('-')/      00019020
      5 13X,'TIME OF 10 MINUTES ARE AVERAGED TO GIVE   SCENARIOS. ALL WEA 00019030
      6THER PARAMETERS REMAIN')                                            00019040
  908 FORMAT(13X,'1 SET OF PREDICTED CONCENTRATIONS.         THE SAME EXC 00019050
      1EPT THE WIND DIRECTION. THE     INPUT UNITS OPTION (NSRCOP):'/    ' 00019060
      2 OPTION 8: 1 TO 24 SCENARIOS WITH 1 HOUR AVERAGING',5X,'WIND DIREC 00019070
      3TION FOR THE FIRST SCENARIO IS'/,13X,'TIMES ARE AVERAGED TO GIVE 1 00019080
      4 SET OF',7X,'THE ONE ENTERED ON THE CARD; FOR EACH',6X,'OPTION 1:  00019090
      5GRID PARAMETERS AND'/13X,'PREDICTED CONCENTRATIONS.'17X,'OF THE SU 00019100
      6CCEEDING SCENARIOS, THE WIND',18X,'SOURCE LOCATIONS')              00019110
  910 FORMAT(55X,'DIRECTION IS INCREASED BY 90,45,30,15,',17X,'IN KM, SO 00019120
      1URCE'/55X,'10, OR 5 DEGREES, DEPENDING ON THE',21X,'PARAMETERS IN  00019130
      2M, M/S,'/' OPTION ',I1,' HAS BEEN SELECTED.',27X,'OPTION USED:',43 00019140
      3X,'GM/S, DEGREES CELSIUS.'/1X,51('-'),46X,'OPTION 2: GRID PARAMETE 00019150
      4RS AND')                                                            00019160

912    FORMAT(55X,'OPTION 2: 90 DEGREE W.D. INCREMENT',21X,'SOURCE LOCATI 00019170
      1ONS'/1X,I2,' SCENARIO(S) ARE INCLUDED IN THIS RUN.',14X,'OPTION 3: 00019180
      2 45 DEGREE W.D. INCREMENT',21X,'IN FT, SOURCE'/19X,'MAXIMUM IS NSC 00019190
      3EN = 24.',14X,'OPTION 4: 30 DEGREE W.D. INCREMENT',21X,'PARAMETERS 00019200
      4 IN FT,'/55X,'OPTION 5: 15 DEGREE W.D. INCREMENT',21X,'FT/S, LB/HR 00019210
      5, DEGREES')                                                         00019220
914    FORMAT(' POLLUTANT(S) ',A3,' ON POLLUTANT SOURCE CARDS',12X,'OPTIO 00019230
      1N 6: 10 DEGREE W.D. INCREMENT',21X,'FAHRENHEIT.'/' ARE MODELED IN  00019240
      2THIS RUN.',30X,'OPTION 7:  5 DEGREE W.D. INCREMENT',9X,'OPTION 3:  00019250
      3MIXED UNITS - GRID'/110X,'PARAMETERS AND SOURCE'/' DT/DZ (E STABIL 00019260
      4ITY) = ',F7.4,80X,'LOCATIONS IN KM,')                              00019270
915    FORMAT(' THE STACK-TIP DOWNWASH ALGORITHM IS IN EFFECT.')           00019280
916    FORMAT(' DT/DZ (F STABILITY) = ',F7.4,80X,'SOURCE PARAMETERS IN'/  00019290
      1110X,'FT, FT/S, LB/HR,'/' PUNCH INTERVAL = ',I3,'.',88X,'DEGREES F 00019300
      2AHRENHEIT.'/)                                                       00019310
917    FORMAT(' THE STACK-TIP DOWNWASH ALGORITHM IS NOT IN EFFECT.')       00019320
918    FORMAT(99X,' (ALL AREA SOURCE INPUT'/106X,' IS IN METRIC UNITS)',  00019330
      1//56X,' OPTION ',I1,' HAS BEEN SELECTED.',16X,'OPTION ',I1,        00019340
      2' HAS BEEN SELECTED.')                                              00019350

919    FORMAT(1X,131('-')/' RECEPTOR GRID CONSISTS OF ',I2,' COLUMNS AND  00019360
      1',I2,' ROWS OF SPACING =',F6.3,' KM.  SOUTHWEST CORNER OF GRID =', 00019370
      2 F8.3,' KM W, ',F8.3,' KM S.')                                      00019380
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920   FORMAT(1X,131('-')/' *** AUTOMATIC GRID OPTION IS IN EFFECT FOR TH 00019390
     1IS RUN ***')                                                      00019400
921   FORMAT(1H0,'AREA SOURCE SCALING FACTOR, 1ST POLLUTANT, = ',F9.4,  00019410
     1 6X,'AREA SOURCE SCALING FACTOR, 2ND POLLUTANT, = ',F9.4)         00019420
922   FORMAT(1H0,'CONCENTRATION CALIBRATION FACTORS:   A(1) = ',F10.4,  00019430
     1 ',  B(1) = ',F10.4,';    A(2) = ',F10.4,',  B(2) = ',F10.4//     00019440
     2' POL 1 ID:',3A4,'  POL 1 CAL ID:',7A4,' / POL 2 ID:',3A4,        00019450
     3 '  POL 2 CAL ID:',7A4)                                           00019460
924   FORMAT(1X,131('-')/' OUTPUT WILL BE PRESENTED IN THE FOLLOWING FOR 00019470
     1M(S):')                                                           00019480
926   FORMAT(52X,'LIST OF CONCENTRATIONS IN GRID, ONE GRID COLUMN PER PA 00019490
     1GE')                                                              00019500
927   FORMAT(52X,'MAP OF CONCENTRATIONS IN GRID, UNCALIBRATED AND CALIBR 00019510
     1ATED')                                                            00019520
928   FORMAT(52X,'MAP OF CONCENTRATIONS IN GRID, UNCALIBRATED ONLY')    00019530
929   FORMAT(52X,'MAP OF CONCENTRATIONS IN GRID, CALIBRATED ONLY')      00019540
930   FORMAT(52X,'PUNCHED CARDS CONTAINING RECEPTOR COORDINATES AND CONC 00019550
     1ENTRATIONS')                                                      00019560

931   FORMAT(52X,'POINT SOURCE CULPABILITY LIST FOR EACH RECEPTOR')     00019570
932   FORMAT(52X,'MAXIMUM PREDICTED CONCENTRATION(S) FOR EACH SCENARIO') 00019580
934   FORMAT(1H1,45X,'T E X A S   E P I S O D I C   M O D E L',32X,     00019590
     1 'VERSION 8 (P-G)'//9X,'SCENARIO PARAMETERS:  ',20A4/1X,131('-')  00019600
     2//17X,'WIND DIRECTIONS',27X,'WIND SPEED CLASSES',12X,'STABILITY CL 00019610
     3ASSES'/)                                                          00019620
935   FORMAT(' SECTOR      DIRECTION     SECTOR       DIRECTION      CLAS 00019630
     1S   SPEED   SPEED CLASS           CLASS'/' NUMBER       (DEGREES)   N 00019640
     2UMBER       (DEGREES)        INDEX    (M/S)   INTERVAL(KT)       INDE 00019650
     3X  CLASS'/4X,'1      N          0.0            9     S      180.0'/ 00019660
     4 4X,'2      NNE      22.5           10     SSW    202.5',11X,'1      1.50 00019670
     5      0- 3',13X,'1        A'/4X,'3      NE       45.0          11     SW 00019680
     6225.0',11X,'2       2.46       4- 6',13X,'2       B')             00019690
936   FORMAT(4X,'4      ENE      67.5           12     WSW    247.5',11X,'3 00019700
     14.47        7-10',13X,'3        C'/4X,'5      E        90.0          13 00019710
     2W      270.0',11X,'4       6.93        11-16',13X,'4       D (DAY)'/ 00019720
     3 4X,'6      ESE     112.5          14     WNW    292.5',11X,'5      9.61 00019730
     4      17-21',13X,'5       D (NIGHT)'/4X,'7      SE     135.0          15 00019740
     5 NW     315.0',11X,'6      12.52       OVER 21',13X,'6          E'/4X,'8 00019750
     6 SSE    157.5          16     NNW    337.5',46X,'7         F'/2X,131('-') 00019760
     7 /)                                                               00019770

937   FORMAT(' SCENARIO  STABILITY   WIND SPEED  WIND SPEED   WIND        W 00019780
     1IND         AMBIENT     HALF-LIFE   HALF-LIFE       INVERSION       M 00019790
     2IXING'/'  NUMBER      CLASS         CLASS     (METERS/SEC) SECTOR  DIR 00019800
     3ECTION  TEMPERATURE    POL. 1       POL. 2     PENETRATION FACTOR    H 00019810
     4EIGHT'/)                                                          00019820
938   FORMAT(4X,I2,9X,A2,10X,I1,9X,F6.3,6X,I2,4X,F6.2,' DEG  ',F7.2,    00019830
     1 ' C    ',2(F6.2,' HR   '),6X,F6.3,7X,F7.1,' M')                  00019840
939   FORMAT(1H1,'T.E.M. VERSION 8 - AREA SOURCE LIST - ',              00019850
     120A4//' NUMBER     X (KM)       Y (KM)      AREA SIZE (KM)     E1 (G/S) 00019860
     2     E2 (G/S)                    '/)                              00019870
940   FORMAT(2X,I4,2(3X,F8.2),6X,F9.4,4X,2(3X,F9.4))                    00019880
945   FORMAT(1H1,'T.E.M. VERSION 8 - POINT SOURCE LIST - ',             00019890
     120A4//' NUMBER     X (KM)       Y (KM)       E1 (G/S)      E2 (G/S)      H 00019900
     1T (M)     DIAM (M)     VEL (M/S)      TEMP (K)      IDENTIFICATION'/) 00019910
950   FORMAT(2X,I4,2(3X,F8.2),1X,2(3X,F9.4),5X,F6.2,5X,F6.3,6X,F7.3,    00019920
     1 5X,F8.3,8X,4A4)                                                  00019930
960   FORMAT(' A DIAMETER OF ZERO IS NOT ALLOWED')                      00019940
965   FORMAT(1H1,'THE AUTOGRID IS NOT PERMITTED WITH NTOPT GREATER THAN 00019950
     1 OR EQUAL TO 5.')                                                 00019960
970   FORMAT(1H0,'THE SUM OF THE AREA SOURCE EMISSION RATES ',          00019970
     1'IN THIS RUN IS ',F9.4,'(G/S) FOR POLLUTANT 1 AND ',F9.4,         00019980
     2'(G/S) FOR POLLUTANT 2.')                                         00019990
                                                                             FO
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975   FORMAT(1H0,'THE SUM OF THE POINT SOURCE EMISSION RATES ',
     1'IN THIS RUN IS ',F9.2,'(G/S) FOR POLLUTANT 1 AND ',F9.2,
     2'(G/S) FOR POLLUTANT 2.')
      END
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$SET OWN LINEINFO STACK OPT=1 $ %    PM26*TEMV8(1).OUTMOD,,,166460110115

      SUBROUTINE OUTMOD
C
C  SUBROUTINE OUTMOD PRINTS AND/OR PUNCHES THE CONCENTRATIONS CALCULATED
C    FOR EVERY RECEPTOR IN THE RECEPTOR GRID. THE PRINTOUT MAY BE IN THE
C    FORM OF A LIST, OR, VIA A CALL TO SUBROUTINE ARRAY, AN ARRAY MAP.
C    OUTMOD ALSO APPLIES CALIBRATION FACTORS TO THE CALCULATED
C    CONCENTRATIONS.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTMU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTOWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IOWN
      DIMENSION CCALIB(2)
      REAL KY,KZ
C  PUNCH TITLE CARD.
      IF(NPUNCH.EQ.1) WRITE(IPU,900)TT
      WOUT= WD(ISCEN)*180./3.1415927
C
C
C   CONTROL STRATEGY RESULTS OUTPUT BY SUBROUTINE WOROUT
      IF(NCSOPT.GT.0.AND.NTOPT.LT.5) CALL WOROUT
      IF(NLIST.LT.1) GO TO 350
C
C  PRINT LIST OF CONCENTRATIONS
C
      DO 300 I=1,LX
      WRITE(IWR,905)TT,ISCEN,SCLAB(ISC),WS(ISCEN),WOUT,HMIX(ISCEN),
     1              TLAB(NTOPT)
      WRITE(IWR,910)(CALNAM(L,1),L=1,7),(CALNAM(L,2),L=1,7),
     1             (POLNAM(L,1),L=1,3),(POLNAM(L,2),L=1,3),
     2              (POLNAM(L,1),L=1,3),(POLNAM(L,2),L=1,3)
      XI=I
      X=XSWC+(XI-0.5)*GRID
      DO 300 J=1,LY
      YJ=J
      Y=YSWC+(YJ-0.5)*GRID
      DO 280 K=1,NPOL
      IF(INPOL.EQ.2) MAQ= 2
      IF(INPOL.NE.2) MAQ= K
C
C  APPLY CALIBRATION COEFFICIENTS A AND B TO CONCENTRATIONS.
C
280   CCALIB(MAQ)= A(MAQ) + B(MAQ)*CONC(I,J,K)
      IF(INPOL.EQ.1) PCONC= CONC(I,J,1)
      IF(INPOL.EQ.1) QCONC= 0.
      IF(INPOL.EQ.2) PCONC= 0.
      IF(INPOL.EQ.2) QCONC= CONC(I,J,1)
      IF(INPOL.EQ.3) PCONC= CONC(I,J,1)
      IF(INPOL.EQ.3) QCONC= CONC(I,J,2)
      IF(INPOL.EQ.1) CCALIB(2)=0.
      IF(INPOL.EQ.2) CCALIB(1)=0.
      WRITE(IWR,970)I,J,X,Y,PCONC,QCONC,(CCALIB(K),K=1,2)
      IF(NPUNCH.EQ.0) GO TO 300
      IF(((I-1)/INTPUN)*INTPUN.NE.(I-1).OR.((J-1)/INTPUN)*INTPUN.NE.
     1 (J-1)) GO TO 300
C
C  PUNCH RECEPTOR COORDINATES AND CONCENTRATIONS.
      WRITE(IPU,975)X,Y,PCONC,QCONC,(CCALIB(K),K=1,2)
300   CONTINUE
C
C  PRINT ARRAY MAPS OF CONCENTRATIONS
C
350   IF(NARRAY.GT.0) CALL ARRAY
C
C  DETERMINE MAXIMUM PREDICTED CONCENTRATION(S) FOR SCENARIO VIA SCENMX
C
      IF(NMAX.GT.0.AND.(NTOPT.LT.5.OR.ISCEN.EQ.NSCEN)) CALL SCENMX
900   FORMAT(20A4)
      RETURN
905   FORMAT(1H1,'PREDICTED CONCENTRATION LIST: ',20A4,4X,'T.E.M. VERSIO
     1N 8'/' SCENARIO ',I2,', STABILITY=',A2,', WIND SPEED=',F5.2,' M/S,
     2 WIND DIRECTION=',F6.2,' DEG, MIXING HEIGHT=',F7.1,' M, AVERAGING
     3TIME=',A4,' HR.'/1X,131('-'))
910   FORMAT(39X,'UNCALIBRATED CONCENTRATIONS:   CALIBRATED CONCENTRATIO
     *N, POL. 1:',7A4/39X,'(MICROGRAMS PER CUBIC METER)   CALIBRATED CON
     1CENTRATION, POL. 2:',7A4/
     2 '  GRID  GRID  RECEPTOR COORDINATES      POLLUTANT 1:     POLLUTANT
     3 2:          POLLUTANT 1:     POLLUTANT 2:'/' COLUMN ROW     X (KM)
     4   Y (KM)      (',3A4,')  (',3A4,')       (',3A4,')  (',3A4,')')
970   FORMAT(3X,I2,3X,I2,1X,2(2X,F9.3),2(7X,F9.4),4X,2(7X,F9.4))
975   FORMAT(6F10.4)
      END
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$SET OWN LINEINFO STACK OPT=1 & Z    PM26*TEMV8(1).ARRAY,,,166655110115

      SUBROUTINE ARRAY
C
C  SUBROUTINE ARRAY CREATES ARRAY MAPS OF THE CONCENTRATIONS IN THE
C    RECEPTOR GRID AND PRINTS THEM AT THE END OF EACH SCENARIO.
C    UNCALIBRATED AND CALIBRATED CONCENTRATIONS OF EACH POLLUTANT
C    APPEAR ON SEPARATE MAPS OF UP TO FOUR SECTIONS (PAGES) EACH.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTHU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUOY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
      DIMENSION X(50),CC(50)
      REAL KY,KZ
      INTEGER CC
      WOUT= WD(ISCEN)*180./3.1415927
      IP= INTPUN
      NLX=1
      NLY=1
      IF(LX.GT.25) NLX=2
      IF(LY.GT.25) NLY=2
      ISECT=0
      NSECT=NLX*NLY
      DO 700 JLX=1,NLX
      MX2= JLX*25
      IF(MX2.GT.LX) MX2=LX
      MX1=1
      IF(JLX.EQ.2) MX1=26
      DO 125 I=MX1,MX2
      XI=I
125   X(I)= XSWC + (XI-0.5)*GRID
      DO 600 JLY=1,NLY
      ISECT=ISECT+1
      IF(JLY.EQ.1) GO TO 150
      MY1=26
      MY2=LY
      GO TO 175
150   MY1=1
      MY2=25
      IF(LY.LT.25) MY2=LY
175   DO 500 N=1,NPOL
      IF(INPOL.EQ.2) MAQ= 2
      IF(INPOL.NE.2) MAQ= N
      IF(NARRAY.EQ.3) GO TO 320
      WRITE(IWR,900)ISECT,NSECT,ISCEN,TT
      WRITE(IWR,902)SCLAB(ISC),WS(ISCEN),WOUT,HMIX(ISCEN),TLAB(NTOPT),
     1               MAQ,(POLNAM(L,MAQ),L=1,3)
      WRITE(IWR,904)
      WRITE(IWR,915)(X(I),I=MX1,MX2,2)
      DO 300 J=MY1,MY2
      IY= MY2 + MY1 - J
      Y=IY
      Y= YSWC + (Y-0.5)*GRID
      DO 230 I=MX1,MX2
```

```
230   CC(I)= CONC(I,IY,N) + 0.5
      WRITE(IWR,920)Y,(CC(I),I=MX1,MX2)
300   WRITE(IWR,925)Y
      WRITE(IWR,915)(X(I),I=MX1,MX2,2)
320   IF(NARRAY.EQ.2) GO TO 500
      WRITE(IWR,900)ISECT,NSECT,ISCEN,IT
      WRITE(IWR,902)SCLAB(ISC),WS(ISCEN),HOUT,HMIX(ISCEN),TLAB(NTOPT),
     1              MAQ,(POLNAM(L,MAQ),L=1,3)
      WRITE(IWR,906)(CALNAM(L,MAQ),L=1,7),A(MAQ),B(MAQ)
      WRITE(IWR,915)(X(I),I=MX1,MX2,2)
      DO 400 J=MY1,MY2
      IY= MY2 + MY1 - J
      Y=IY
      Y= YSWC + (Y-0.5)*GRID
      DO 330 I=MX1,MX2
330   CC(I)= A(MAQ) + B(MAQ)*CONC(I,IY,N) + 0.5
      WRITE(IWR,920)Y,(CC(I),I=MX1,MX2)
400   WRITE(IWR,925)Y
      WRITE(IWR,915)(X(I),I=MX1,MX2,2)
500   CONTINUE
600   CONTINUE
700   CONTINUE
      RETURN
900   FORMAT(1H1,'SECTION ',I1,' OF ',I1,', SCENARIO ',I2,2X,20A4,
     1 5X,'T.E.M. VERSION 8')
902   FORMAT(' STABILITY=',A2,', WIND SPD=',F5.2,' M/S, WIND DIR=',F6.2,
     1 ' DEG, MIXING HT=',F7.1,' M, AVERAGING TIME=',A4,' HR.',6X,
     2 'POLLUTANT ',I1,', ',3A4)

904   FORMAT(' UNCALIBRATED CONCENTRATIONS - MICROGRAMS PER CUBIC METER'
     1)
906   FORMAT(' CALIBRATED CONCENTRATIONS, ',7A4,18X,'CALIBRATION COEFFIC
     1IENTS:  A =',F11.5,',  B =',F11.5)
910   FORMAT(27X,20A4)
915   FORMAT(1H0,16X,13F8.2)
920   FORMAT(1H0,4X,F8.2,4X,25I4)
925   FORMAT(1H+,122X,F8.2)
      END
```

```
$SET OWN LINEINFO STACK OPT=1 $ %   PM26*TEMV8(1).AUTGRD,,,072246110215
      SUBROUTINE AUTGRD
C
C   SUBROUTINE AUTGRID CALCULATES THE FIVE PARAMETERS DEFINING THE
C     RECEPTOR GRID (XSWC,YSWC,LX,LY,GRID) WHEN THE AUTOMATIC GRID
C     OPTION IS USED. THIS IS DONE BY SETTING GRID=0.0 IN THE INPUT
C     DATA. GRID PARAMETERS WILL BE CHOSEN FOR EACH SCENARIO SO AS
C     TO INSURE GOOD COVERAGE BY RECEPTORS NEAR THE POINT OF
C     MAXIMUM CONCENTRATION.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),DLIM(20),HLIN(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTMU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTOWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IOWN
      DIMENSION XCRNR(4),YCRNR(4),HL(2),DL(2),XTM(2)
      DIMENSION AG(7,2),BG(7,2),DG(7)
      DATA AG/.0383,.1393,.112,.0856,.0818,.1094,.05645,
     1        .0002539,.04395,.1014,.2591,.2527,.2452,.1930/
      DATA BG/1.281,.9467,.9100,.865,.8155,.7657,.805,
     1        2.089,1.114,.926,.6869,.6341,.6358,.6072/
      DATA DG/.873,.897,.908,.916,.916,.912,.911/
      E= 1.570796 -WVEC
      SINEE= SIN(E)
      COSNE= COS(E)
      GX1= XP(1)*COSNE  + YP(1)*SINEE
      GX2= GX1
      GY1= YP(1)*COSNE  - XP(1)*SINEE
      GY2= GY1
      DO 200 I=1,NPS
      XT= XP(I)*COSNE  + YP(I)*SINEE
      YT= YP(I)*COSNE  - XP(I)*SINEE
      IBUDY=1
      IF(VP(I).GT.90.67*(TP(I)-TA(ISCEN))*SQRT(TA(ISCEN))/TP(I)) IBUDY=0
      IRISE=2
      UINV = 1./WS(ISCEN)
      IF(HP(I).GT.10.) UINV = UINV*((10./HP(I))**P(ISC))
      EFF= 2.45*VP(I)*DP(I)*DP(I)*(TP(I)-TA(ISCEN))/TP(I)
      IPS=I
      HL(1)= HP(I)
      CALL RISE
      HL(2)= ESH(2)
      DO 170 J=1,2
      DL(J)=(BG(ISC,2)*HL(J)*HL(J)/(AG(ISC,2)*AG(ISC,2)*(BG(ISC,2)+DG(IS
     1C))))**(0.5/BG(ISC,2))*0.001
      IF(DL(J).GE.400.) GO TO 170
      DL(J)=(BG(ISC,1)*HL(J)*HL(J)/(AG(ISC,1)*AG(ISC,1)*(BG(ISC,1)+DG(IS
     1C))))**(0.5/BG(ISC,1))*0.001
170   XTM(J)= XT + DL(J)
      IF(XTM(2).GT.GX2) GX2= XTM(2)
      IF(XTM(1).LT.GX1) GX1= XTM(1)
      IF(YT.GT.GY2)     GY2= YT
      IF(YT.LT.GY1)     GY1= YT
200   CONTINUE
      XCRNR(1)= GX1
      XCRNR(2)= GX2
      XCRNR(3)= GX2
      XCRNR(4)= GX1
      YCRNR(1)= GY1
      YCRNR(2)= GY1
      YCRNR(3)= GY2
      YCRNR(4)= GY2
      DO 300 J=1,4
      XCRNRT= XCRNR(J)
      XCRNR(J)= XCRNR(J)*COSNE  - YCRNR(J)*SINEE
300   YCRNR(J)= YCRNR(J)*COSNE + XCRNRT*SINEE
      XSWC= XCRNR(1)
      XNEC= XSWC
      YSWC= YCRNR(1)
      YNEC= YSWC
      DO 400 I=2,4
      IF(XCRNR(I).GT.XNEC) XNEC= XCRNR(I)
      IF(XCRNR(I).LT.XSWC) XSWC= XCRNR(I)
      IF(YCRNR(I).GT.YNEC) YNEC= YCRNR(I)
400   IF(YCRNR(I).LT.YSWC) YSWC= YCRNR(I)
      XT= XNEC - XSWC
      YT= YNEC - YSWC
      DMAX= XT
      IF(YT.GT.XT) DMAX= YT
      IF(DMAX.LT.10.) GO TO 500
      IF(XT.GT.YT) GO TO 420
      LY=  50
      GRID= YT/50.
      LX= XT/GRID
      IF(LX.LT.50) LX= LX+1
      GO TO 600
420   LX= 50
      GRID= XT/50.
      LY= YT/GRID
      IF(LY.LT.50) LY=LY+1
      GO TO 600
500   IF(DMAX.LT.5.) GO TO 540
      GRID= 0.2
      LX= XT/GRID
      LY= YT/GRID
      IF(LX.LT.50) LX=LX+1
      IF(LY.LT.50) LY=LY+1
      GO TO 600
540   IF(DMAX.LT.0.25) GO TO 580
      IF(XT.GT.YT) GO TO 560
      LY= 25
      GRID= YT/25.
      LX= XT/GRID
      IF(LX.LT.25) LX=LX+1
      GO TO 600
560   LX= 25
      GRID= XT/25.
      LY= YT/GRID
      IF(LY.LT.25) LY=LY+1
      GO TO 600
580   GRID= 0.01
      LX= XT/GRID
      LY= YT/GRID
      IF(LX.LT.25) LX=LX+1
      IF(LY.LT.25) LY=LY+1
600   XSWC= XSWC - 0.5*GRID
      YSWC= YSWC - 0.5*GRID
      IF(NCSOPT.LT.1.OR.(LX.LE.25.AND.LY.LE.25)) GO TO 700
      XL=LX
      YL=LY
      IF(LX.GT.LY) GO TO 640
      DELG= YL/25.
      LY=25
      GRID= GRID*DELG
      LX= XL/DELG
      IF(LX.LT.25) LX=LX+1
      GO TO 700
640   DELG= XL/25.
      LX=25
      GRID= GRID*DELG
      LY= YL/DELG + 1.
700   CONTINUE
      WRITE(IWR,900)ISCEN,IWDOPT,TT
      XRSWC=XSWC+0.5*GRID
      YRSWC=YSWC+0.5*GRID
      WRITE(IWR,905)LX,LY,GRID,XRSWC,YRSWC
900   FORMAT(1H1,'T.E.M. VERSION 8:   AUTOMATICALLY GENERATED RECEPTOR G
     1RID PARAMETERS FOR SCENARIO ',I2,'  (WIND DIRECTION SUB-SCENARIO '
     2,I2,')'//21X,20A4/1X,120('-')//)
905   FORMAT(' RECEPTOR GRID CONSISTS OF ',I2,' COLUMNS AND ',I2,' ROWS
     1OF SPACING =',F7.4,' KM. SOUTHWEST CORNER OF GRID =',F8.3,' KM (,
     2',F8.3,' KM ).')
      RETURN
      END
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```
$SET OWN LINEINFO STACK OPT=1 & 2   PM26*TEMV8(1).WOROUT,,,072660110215

      SUBROUTINE WOROUT
C
C  SUBROUTINE WOROUT PRINTS A CULPABILITY LIST OF THE IDENTIFICATIONS
C    AND CONTRIBUTIONS OF THE FIVE POINT SOURCES CONTRIBUTING THE MOST
C    TO THE TOTAL CONCENTRATION AT EACH RECEPTOR, USING DATA COMPILED
C    BY SUBROUTINE WORST.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),DLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D90,D47,D9047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTB,CTMU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
      WOUT= WD(ISCEN)*180./3.1415927
      IF(INPOL.EQ.2) MAQ=2
      IF(INPOL.NE.2) MAQ=1
      N=1
      IF(NTOPT.LT.5) GO TO 250
      N=2
250   DO 400 I=1,LY
      WRITE(IWR,905)ISCEN
      WRITE(IWR,910)TT,(POLNAM(L,MAQ),L=1,3)
      WRITE(IWR,915)WOUT,WS(ISCEN),SCLAB(ISC),HMIX(ISCEN),TLAB(NTOPT)
      WRITE(IWR,920)
      XI=I
      X= XSWC + (XI-0.5)*GRID
      DO 400 J=1,LY
      IF(CONC(I,J,N).LT.1.0E-5) GO TO 303
      DO 300 L=1,5
300   CWORST(I,J,L)= CWORST(I,J,L)*100./CONC(I,J,N)
303   YJ=J
      Y= YSWC + (YJ-0.5)*GRID
      WRITE(IWR,925)I,J,X,Y,NWORST(I,J,1),CWORST(I,J,1),NWORST(I,J,2),
     1 CWORST(I,J,2),NWORST(I,J,3),CWORST(I,J,3),NWORST(I,J,4),
     2 CWORST(I,J,4),NWORST(I,J,5),CWORST(I,J,5),CONC(I,J,N)
400   CONTINUE
905   FORMAT(1H1,'TEXAS EPISODIC MODEL, VERSION 8 - LIST OF THE 5 POINT
     1SOURCES PRODUCING THE HIGHEST CONCENTRATIONS AT EACH RECEPTOR  -
     2SCENARIO ',I2/)
910   FORMAT(1X,20A4,' / ',3A4,' - CONCENTRATIONS IN MICROGRAMS/CU M')
915   FORMAT(1H ,'WIND DIRECTION = ',F5.1,' DEG., WIND SPD = ',F5.2,
     1 ' M/S, STABILITY CLASS = ',A2,', MIXING HEIGHT = ',F7.2,' M, AVER
     2AGING TIME = ',A4,' HR.')
920   FORMAT(1H0,17X,'RECEPTOR COORDINATES       POINT SOURCE SEQUENCE NU
     1MBER AND PERCENT OF TOTAL CONCENTRATION AT RECEPTOR     TOTAL FOR'
     2/' COLUMN ROW     X (KM)      Y (KM)        NO.  HIGHEST    NO. 2ND
     3HIGH    NO. 3RD HIGH    NO. 4TH HIGH    NO. 5TH HIGH     RECEPTOR'
     4)

925   FORMAT(1H0,1X,I2,3X,I2,5X,2(F8.2,3X),5(4X,I3,':',F8.2),5X,F8.2)
      RETURN
      END
```

```
$SET OWN LINEINFO STACK OPT=1 & X   PM25*TEMV8(1).MAXOUT,,,07355/110215

      SUBROUTINE MAXOUT
C
C   SUBROUTINE MAXOUT PRINTS THE COORDINATES AND CONCENTRATIONS AT THE
C     RECEPTOR GRID POINTS RECORDING THE HIGHEST CONCENTRATIONS OF EACH
C     POLLUTANT IN EACH SCENARIO. VALUES WERE SELECTED AND STORED
C     BY SUBROUTINE SCENMX.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7),XP(300),
     1 YP(300),EP(300,2),HP(300),DP(300),VP(300),TP(300),XA(50),
     2 YA(50),EA(50,2),SIZE(50),AX(7,3),BX(7,3),HALF(24,2),
     3 DCR(24,2),DECAY(20,2),TT(20),CLIM(20),HLIM(14),PEN(24),DEL(7),
     4 CWS(6),P(7),SCLAB(7),TLAB(8),HMIX(24),WS(24),TA(24),WD(24),
     5 PSC(7),ST(8),DTDZ(2),ASCALE(2),A(2),B(2),ESH(2),FSH,NSH,PEAK,
     6 NWS(24),NSC(24),NWD(24),XSWC,YSWC,GRID,D80,D47,D8047,DIST,DELTA,
     7 FDIST,WVEC,TBASE,CTH,CTMU,EFF,XS,UINV,KZC,KYC,LX,LY,IBUDY,IRISE,
     8 IPS,IWDOPT,INTPUN,ISCEN,INDEX,ISC,IWS,IWD,IRD,IWR,IPU,IDSK,NTOPT,
     9 NWDOPT,NSCEN,NPOL,NLIST,NARRAY,NPUNCH,NCSOPT,NSTDWN,NMAX,
     * INPOL,NAS,NPS,NDIST,IGRID,POLNAM(3,2),CALNAM(7,2),
     * NWORST(25,25,5),CWORST(25,25,5),NPRINT,
     * XMX(24,4,2),YMX(24,4,2),ZMX(24,4,2),IDWN
      DIMENSION ZC(2)
      IF(NWDOPT.GT.1) GO TO 300
      WRITE(IWR,900)TT,(CALNAM(L,1),L=1,7),(CALNAM(L,2),L=1,7)
      WRITE(IWR,901) (POLNAM(L,1),L=1,3),(POLNAM(L,2),L=1,3)
      J= 1
      N= 1
      IF(NTOPT.LT.5) N= NSCEN
      DO 200 I=1,N
      DO 120 K=1,NPOL
      IF(INPOL.EQ.2)MAQ= 2
      IF(INPOL.NE.2)MAQ= K
120   ZC(MAQ)= A(MAQ) + B(MAQ)*ZMX(I,1,K)
      WRITE(IWR,902)
      IF(INPOL.EQ.2)  WRITE(IWR,912) I, J, XMX(I,1,1), YMX(I,1,1),
     *  ZMX(I,1,1), ZC(2)
      IF(INPOL.EQ.2) GO TO 200
      WRITE(IWR,910)I,J,(XMX(I,1,K),YMX(I,1,K),ZMX(I,1,K),ZC(K),K=1,NPOL
     1)
200   CONTINUE
      GO TO 700
300   N= NSCEN
      DO 500 I=1,N
      IF(((I-1)/8)*8.NE.I-1) GO TO 310
      WRITE(IWR,900)TT,(CALNAM(L,1),L=1,7),(CALNAM(L,2),L=1,7)
      WRITE(IWR,901) (POLNAM(L,1),L=1,3),(POLNAM(L,2),L=1,3)
310   WRITE(IWR,902)
      DO 400 J=1,4
      DO 320 K=1,NPOL
      IF(INPOL.EQ.2) MAQ=2
      IF(INPOL.NE.2) MAQ=K
320   ZC(MAQ)= A(MAQ) + B(MAQ)*ZMX(I,J,K)
      IF(INPOL.EQ.2) WRITE(IWR,912) I,J,XMX(I,J,1),YMX(I,J,1),
     *  ZMX(I,J,1),ZC(2)
      IF(INPOL.EQ.2) GO TO 400
      WRITE(IWR,910)I,J,(XMX(I,J,K),YMX(I,J,K),ZMX(I,J,K),ZC(K),K=1,NPOL
     1)
400   CONTINUE
500   CONTINUE
700   RETURN
900   FORMAT(1H1,14X,'TEXAS EPISODIC MODEL, VERSION 8:  HIGHEST PREDICTE
     1D CONCENTRATIONS OF EACH POLLUTANT FOR EACH SCENARIO'//21X,20A4/
     2 1X,131('-')/' UNCALIBRATED CONCENTRATIONS IN MICROGRAMS PER CUBIC
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     3 METER  -  CALIBRATION, POLLUTANT 1: ',7A4/63X,'CALIBRATION, POLLU 00024700
     4TANT 2: ',7A4//)                                                  00024710
  901 FORMAT(27X,'RECEPTOR COORDINATES    POLLUTANT 1 (',3A4,')    RECEP 00024720
     1TOR COORDINATES    POLLUTANT 2 (',3A4,')'/' SCENARIO  WIND DIRECTI 00024730
     2ON',25X,'UNCALIBRATED    CALIBRATED',28X,'UNCALIBRATED    CALIBRAT 00024740
     3ED'/'  NUMBER    SUB-SCENARIO      X (KM)    Y (KM)    CONCENTRATI 00024750
     4ON  CONCENTRATION      X (KM)    Y(KM)    CONCENTRATION  CONCENTR 00024760
     5ATION')                                                           00024770
  902 FORMAT(1X)                                                        00024780
  910 FORMAT(4X,I2,11X,I2,8X,2(1X,F9.3),2(5X,F10.4),4X,2(1X,F9.3),      00024790
     1 2(5X,F10.4))                                                     00024800
  912 FORMAT(4X,I2,11X,I2,62X,2(1X,F9.3),2(5X,F10.4))                   00024810
      END                                                               00024820
```

```
$SET OWN LINEINFO STACK OPT=1 & X   PM26*TEMV8(1).INDATA,,,165257111015
      SUBROUTINE INDATA(NTOPT,ANGLIM,DEL)
C
C  THIS SUBROUTINE SELECTS THE PROPER VALUES FOR KY, ANGLIM, DEL
C  DEPENDING UPON WHETHER THE AVERAGING TIME IS 10 MIN, 30 MIN,
C  1 HR, 3 HR, 24 HR, OR MULTIPLES THEREOF.
C
      COMMON/TEMCOM/CONC(50,50,2),KZ(20,14,7),KY(20,8,7)
      DIMENSION ANGLIM(7),DEL(7),ANGLI1(7),DEL1(7),KY1(20,8,7),
     1 ANGLI2(7),DEL2(7),KY2(20,8,7),ANGLI3(7),DEL3(7),KY3(20,8,7),
     2 ANGLI4(7),DEL4(7),KY4(20,8,7)
      REAL KZ,KY,KY1,KY2,KY3,KY4
      DATA DEL1/0.0872665,0.0698132,0.0523599,0.0349066,
     2 0.0349066,0.0261799,0.01745329/
      DATA ANGLI1/0.610865,0.488692,0.366519,0.244346,
     2 0.244346,0.183260,0.122173/
      DATA DEL2/0.1256637,0.0959931,0.0645772,0.0383972,
     2 0.0383972,0.0261799,0.01745329/
      DATA ANGLI2/0.879646,0.671952,0.452040,0.268781,
     2 0.268781,0.183260,0.122173/
      DATA DEL3/0.1570796,0.1239184,0.0820305,0.0471239,
     2 0.0471239,0.0296706,0.0191986/
      DATA ANGLI3/1.0995574,0.8674286,0.5742133,0.3298672,
     2 0.3298672,0.2076942,0.1343904/
      DATA DEL4/0.1902409,0.1623156,0.1134464,0.0628319,
     2 0.0628319,0.0349066,0.0226893/
      DATA ANGLI4/1.3316862,1.1362093,0.7941248,0.4398230,
     2 0.4398230,0.2443461,0.1588250/
C
C  KY CONTAINS PRECALCULATED COEFFICIENTS DEPENDENT ON DOWNWIND
C  DISTANCE, CROSSWIND DISTANCE, AND STABILITY CLASS FOR USE IN
C  THE GAUSSIAN PLUME POINT SOURCE EQUATION.
C
C
C  THE KY DATA TABLE IS IN THE FOLLOWING FORMAT:
C
C     KY1=10 MINUTE AVERAGING TIMES
C
C KY1(I,J,K)=KY1(DOWNWIND DISTANCE, CROSSWIND
C                DISTANCE, STABILITY CLASS)
C
C
C  **** STABILITY CLASS A ****
C
      DATA(KY1(I,1,1),I=1,20)/    2.65213,  1.86152,  1.44809,  1.19177,
     1                            1.01641,   .88843,   .79067,   .65072,
     2                             .55737,   .48885,   .41440,   .36087,
     3                             .32040,   .27954,   .24853,   .21883,
     4                             .19591,   .17441,   .15746,   .14168/
      DATA(KY1(I,2,1),I=1,20)/    2.38140,  1.65208,  1.27359,  1.04034,
     1                             .88156,   .76620,   .67842,   .55337,
     2                             .46967,   .40862,   .34271,   .29564,
     3                             .26028,   .22478,   .19802,   .17257,
     4                             .15304,   .13486,   .12062,   .10745/
      DATA(KY1(I,3,1),I=1,20)/    1.71255,  1.14633,   .85956,   .68622,
     1                             .57013,   .43697,   .42449,   .33691,
     2                             .27805,   .23602,   .19158,   .16057,
     3                             .13774,   .11531,   .09877,   .08339,
     4                             .07186,   .06136,   .05333,   .04607/
      DATA(KY1(I,4,1),I=1,20)/     .96595,   .60763,   .43422,   .33312,
     1                             .26745,   .22164,   .18802,   .14231,
     2                             .11197,   .09098,   .06977,   .05562,
     3                             .04561,   .03617,   .02951,   .02358,
     4                             .01933,   .01563,   .01292,   .01058/ 00025460
      DATA(KY1(I,5,1),I=1,20)/     .41138,   .23590,   .15691,   .11344, 00025470
     1                             .08654,   .06856,   .05585,   .03938, 00025480
     2                             .02879,   .02197,   .01548,   .01145, 00025490
     3                             .00878,   .00642,   .00487,   .00359, 00025500
     4                             .00273,   .00204,   .00156,   .00118/ 00025510
      DATA(KY1(I,6,1),I=1,20)/     .12449,   .06270,   .03772,   .02510, 00025520
     1                             .01782,   .01326,   .01021,   .00652, 00025530
     2                             .00430,   .00300,   .00188,   .00125, 00025540
     3                             .00087,   .00057,   .00039,   .00026, 00025550
     4                             .00018,   .00012,   .00008,   .00005/ 00025560
      DATA(KY1(I,7,1),I=1,20)/     .02438,   .01029,   .00540,   .00321, 00025570
     1                             .00207,   .00141,   .00100,   .00056, 00025580
     2                             .00032,   .00020,   .00011,   .00006, 00025590
     3                             .00004,   .00002,   .00001,   .00001, 00025600
     4                             .00000,   .00000,   .00000,   .00000/ 00025610
      DATA(KY1(I,8,1),I=1,20)/     .00268,   .00089,   .00039,   .00020, 00025620
     1                             .00011,   .00007,   .00004,   .00002, 00025630
     2                             .00001,   .00001,   .00000,   .00000, 00025640
     3                             .00000,   .00000,   .00000,   .00000, 00025650
     4                             .00000,   .00000,   .00000,   .00000/ 00025660
C                                                                      00025670
C    **** STABILITY CLASS B ****                                       00025680
C                                                                      00025690
      DATA(KY1(I,1,2),I=1,20)/    3.52870,  2.45279,  1.89492,  1.55118, 00025700
     1                            1.31715,  1.14706,  1.01758,   .83299, 00025710
     2                             .71612,   .62914,   .53447,   .46627, 00025720
     3                             .41462,   .36237,   .32267,   .28458, 00025730
     4                             .25513,   .22748,   .20564,   .18529/ 00025740
      DATA(KY1(I,2,2),I=1,20)/    3.12413,  2.14867,  1.64660,  1.33903, 00025750
     1                            1.13063,   .97978,   .86537,   .70301, 00025760
     2                             .59783,   .52045,   .43678,   .37696, 00025770
     3                             .33196,   .28675,   .25265,   .22017, 00025780
     4                             .19525,   .17202,   .15381,   .13697/ 00025790
      DATA(KY1(I,3,2),I=1,20)/    2.15770,  1.43691,  1.07443,   .85637, 00025800
     1                             .71082,   .60683,   .52885,   .41979, 00025810
     2                             .34534,   .29242,   .23651,   .19754, 00025820
     3                             .16889,   .14079,   .12012,   .10093, 00025830
     4                             .08659,   .07357,   .06363,   .05467/ 00025840
      DATA(KY1(I,4,2),I=1,20)/    1.14544,   .72185,   .51754,   .39857, 00025850
     1                             .32129,   .26734,   .22773,   .17374, 00025860
     2                             .13505,   .10905,   .08279,   .06538, 00025870
     3                             .05315,   .04169,   .03366,   .02658, 00025880
     4                             .02154,   .01720,   .01405,   .01136/ 00025890
      DATA(KY1(I,5,2),I=1,20)/     .45534,   .26480,   .17858,   .13081, 00025900
     1                             .10104,   .08100,   .06674,   .04806, 00025910
     2                             .03439,   .02592,   .01795,   .01306, 00025920
     3                             .00986,   .00708,   .00528,   .00380, 00025930
     4                             .00284,   .00207,   .00156,   .00115/ 00025940
      DATA(KY1(I,6,2),I=1,20)/     .13027,   .06793,   .04216,   .02886, 00025950
     1                             .02104,   .01603,   .01263,   .00841, 00025960
     2                             .00538,   .00369,   .00225,   .00147, 00025970
     3                             .00100,   .00064,   .00043,   .00027, 00025980
     4                             .00018,   .00012,   .00008,   .00005/ 00025990
      DATA(KY1(I,7,2),I=1,20)/     .02533,   .01145,   .00638,   .00399, 00026000
     1                             .00270,   .00192,   .00143,   .00086, 00026010
     2                             .00047,   .00029,   .00015,   .00008, 00026020
     3                             .00005,   .00003,   .00002,   .00001, 00026030
     4                             .00000,   .00000,   .00000,   .00000/ 00026040
      DATA(KY1(I,8,2),I=1,20)/     .00309,   .00116,   .00056,   .00031, 00026050
     1                             .00019,   .00013,   .00009,   .00005, 00026060
     2                             .00002,   .00001,   .00000,   .00000, 00026070
     3                             .00000,   .00000,   .00000,   .00000, 00026080
     4                             .00000,   .00000,   .00000,   .00000/ 00026090
```

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C                                                                               00026100
C   **** STABILITY CLASS C ****                                                 00026110
C                                                                               00026120
      DATA(KY1(I,1,3),I=1,20)/      5.10738,   3.53433,   2.72134,   2.22264,   00026130
     1                              1.88353,   1.63751,   1.45053,   1.18450,   00026140
     2                              1.01978,    .89220,    .75397,    .65438,   00026150
     3                               .58015,    .50485,    .44786,    .39341,   00026160
     4                               .35146,    .31221,    .28132,    .25264/   00026170
      DATA(KY1(I,2,3),I=1,20)/      4.42556,   3.02870,   2.31296,   1.87590,   00026180
     1                              1.58052,   1.36717,   1.20563,    .97691,   00026190
     2                               .83022,    .72013,    .60169,    .51743,   00026200
     3                               .45431,    .39115,    .34370,    .29868,   00026210
     4                               .26426,    .23229,    .20731,    .18427/   00026220
      DATA(KY1(I,3,3),I=1,20)/      2.87014,   1.39944,   1.41423,   1.12359,   00026230
     1                               .93026,    .79251,    .68946,    .54573,   00026240
     2                               .44594,    .37688,    .30427,    .25339,   00026250
     3                               .21699,    .13091,    .15444,    .12992,   00026260
     4                               .11163,    .09505,    .08240,    .07101/   00026270
      DATA(KY1(I,4,3),I=1,20)/      1.37982,    .86279,    .61542,    .47219,   00026280
     1                               .37955,    .31511,    .26792,    .20383,   00026290
     2                               .15587,    .12606,    .09603,    .07615,   00026300
     3                               .06218,    .04910,    .03992,    .03179,   00026310
     4                               .02599,    .02097,    .01731,    .01415/   00026320
      DATA(KY1(I,5,3),I=1,20)/       .48365,    .27883,    .18704,    .13652,   00026330
     1                               .10519,    .08417,    .06925,    .04978,   00026340
     2                               .03462,    .02629,    .01843,    .01359,   00026350
     3                               .01039,    .00759,    .00575,    .00424,   00026360
     4                               .00323,    .00241,    .00185,    .00141/   00026370
      DATA(KY1(I,6,3),I=1,20)/       .12063,    .06246,    .03862,    .02639,   00026380
     1                               .01922,    .01465,    .01154,    .00769,   00026390
     2                               .00472,    .00330,    .00207,    .00139,   00026400
     3                               .00097,    .00064,    .00044,    .00029,   00026410
     4                               .00020,    .00014,    .00010,    .00007/   00026420
      DATA(KY1(I,7,3),I=1,20)/       .02071,    .00935,    .00522,    .00328,   00026430
     1                               .00222,    .00159,    .00119,    .00072,   00026440
     2                               .00038,    .00024,    .00013,    .00008,   00026450
     3                               .00005,    .00003,    .00002,    .00001,   00026460
     4                               .00001,    .00000,    .00000,    .00000/   00026470
      DATA(KY1(I,8,3),I=1,20)/       .00234,    .00089,    .00044,    .00025,   00026480
     1                               .00015,    .00010,    .00007,    .00004,   00026490
     2                               .00002,    .00001,    .00000,    .00000,   00026500
     3                               .00000,    .00000,    .00000,    .00000,   00026510
     4                               .00000,    .00000,    .00000,    .00000/   00026520
C                                                                               00026530
C   **** STABILITY CLASS D-DAY ****                                             00026540
C                                                                               00026550
      DATA(KY1(I,1,4),I=1,20)/      7.76062,   5.35300,   4.11295,   3.35261,   00026560
     1                              2.83696,   2.46337,   2.17977,   1.77681,   00026570
     2                              1.53444,   1.34289,   1.13528,    .98640,   00026580
     3                               .87407,    .76087,    .67517,    .59325,   00026590
     4                               .53013,    .47106,    .42456,    .38137/   00026600
      DATA(KY1(I,2,4),I=1,20)/      6.70044,   4.57411,   3.48724,   2.82471,   00026610
     1                              2.37755,   2.05491,   1.81087,   1.46569,   00026620
     2                              1.24787,   1.08254,    .90463,    .77802,   00026630
     3                               .68317,    .58824,    .51690,    .44922,   00026640
     4                               .39745,    .34936,    .31179,    .27714/   00026650
      DATA(KY1(I,3,4),I=1,20)/      4.30626,   2.84950,   2.12210,   1.68662,   00026660
     1                              1.39704,   1.19073,   1.03641,    .82116,   00026670
     2                               .66980,    .56590,    .45667,    .38090,   00026680
     3                               .32540,    .27114,    .23135,    .19450,   00026690
     4                               .16702,    .14211,    .12312,    .10602/   00026700
      DATA(KY1(I,4,4),I=1,20)/      2.05118,   1.28815,    .92234,    .71010,   00026710
     1                               .57256,    .47672,    .40641,    .31069,   00026720
     2                               .23585,    .19062,    .14507,    .11494,   00026730
     3                               .09377,    .07395,    .06005,    .04776, 00026740
     4                               .03900,    .03142,    .02590,    .02115/ 00026750
      DATA(KY1(I,5,4),I=1,20)/       .71884,    .41927,    .28397,    .20901, 00026760
     1                               .16224,    .13068,    .10818,    .07863, 00026770
     2                               .05392,    .04093,    .02868,    .02112, 00026780
     3                               .01615,    .01178,    .00892,    .00656, 00026790
     4                               .00499,    .00372,    .00286,    .00217/ 00026800
      DATA(KY1(I,6,4),I=1,20)/       .18341,    .09716,    .06121,    .04249, 00026810
     1                               .03138,    .02421,    .01929,    .01313, 00026820
     2                               .00789,    .00552,    .00347,    .00233, 00026830
     3                               .00163,    .00108,    .00074,    .00049, 00026840
     4                               .00034,    .00023,    .00016,    .00011/ 00026850
      DATA(KY1(I,7,4),I=1,20)/       .03360,    .01579,    .00909,    .00587, 00026860
     1                               .00408,    .00298,    .00227,    .00142, 00026870
     2                               .00072,    .00046,    .00025,    .00015, 00026880
     3                               .00009,    .00006,    .00003,    .00002, 00026890
     4                               .00001,    .00001,    .00000,    .00000/ 00026900
      DATA(KY1(I,8,4),I=1,20)/       .00434,    .00177,    .00091,    .00054, 00026910
     1                               .00035,    .00024,    .00017,    .00010, 00026920
     2                               .00004,    .00002,    .00001,    .00001, 00026930
     3                               .00000,    .00000,    .00000,    .00000, 00026940
     4                               .00000,    .00000,    .00000,    .00000/ 00026950
C                                                                         00026960
C   **** STABILITY CLASS D-NIGHT ****                                     00026970
C                                                                         00026980
      DATA(KY1(I,1,5),I=1,20)/      7.76062,   5.35300,   4.11295,   3.35261, 00026990
     1                              2.83696,   2.46337,   2.17977,   1.77681, 00027000
     2                              1.53444,   1.34289,   1.13528,    .98640, 00027010
     3                               .87407,    .76087,    .67517,    .59325, 00027020
     4                               .53013,    .47106,    .42456,    .38137/ 00027030
      DATA(KY1(I,2,5),I=1,20)/      6.70044,   4.57411,   3.48724,   2.82471, 00027040
     1                              2.37755,   2.05491,   1.81087,   1.46569, 00027050
     2                              1.24787,   1.08254,    .90463,    .77802, 00027060
     3                               .68317,    .58824,    .51690,    .44922, 00027070
     4                               .39745,    .34936,    .31179,    .27714/ 00027080
      DATA(KY1(I,3,5),I=1,20)/      4.30626,   2.84950,   2.12210,   1.68662, 00027090
     1                              1.39704,   1.19073,   1.03641,    .82116, 00027100
     2                               .66930,    .56590,    .45667,    .38090, 00027110
     3                               .32540,    .27114,    .23135,    .19450, 00027120
     4                               .16702,    .14211,    .12312,    .10602/ 00027130
      DATA(KY1(I,4,5),I=1,20)/      2.05118,   1.28815,    .92234,    .71010, 00027140
     1                               .57256,    .47672,    .40641,    .31069, 00027150
     2                               .23585,    .19062,    .14507,    .11494, 00027160
     3                               .09377,    .07395,    .06005,    .04776, 00027170
     4                               .03900,    .03142,    .02590,    .02115/ 00027180
      DATA(KY1(I,5,5),I=1,20)/       .71884,    .41927,    .28397,    .20901, 00027190
     1                               .16224,    .13068,    .10818,    .07863, 00027200
     2                               .05392,    .04093,    .02868,    .02112, 00027210
     3                               .01615,    .01178,    .00892,    .00656, 00027220
     4                               .00499,    .00372,    .00286,    .00217/ 00027230
      DATA(KY1(I,6,5),I=1,20)/       .18341,    .09716,    .06121,    .04249, 00027240
     1                               .03138,    .02421,    .01929,    .01313, 00027250
     2                               .00789,    .00552,    .00347,    .00233, 00027260
     3                               .00163,    .00108,    .00074,    .00049, 00027270
     4                               .00034,    .00023,    .00016,    .00011/ 00027280
      DATA(KY1(I,7,5),I=1,20)/       .03360,    .01579,    .00909,    .00587, 00027290
     1                               .00408,    .00298,    .00227,    .00142, 00027300
     2                               .00072,    .00046,    .00025,    .00015, 00027310
     3                               .00009,    .00006,    .00003,    .00002, 00027320
     4                               .00001,    .00001,    .00000,    .00000/ 00027330
      DATA(KY1(I,8,5),I=1,20)/       .00434,    .00177,    .00091,    .00054, 00027340
     1                               .00035,    .00024,    .00017,    .00010, 00027350
     2                               .00004,    .00002,    .00001,    .00001, 00027360
     3                               .00000,    .00000,    .00000,    .00000, 00027370
     4                            .00000,   .00000,   .00000,   .00000/ 00027380
C                                                                       00027390
C    **** STABILITY CLASS E ****                                        00027400
C                                                                       00027410
      DATA(KY1(I,1,6),I=1,20)/  10.44994,  7.21960,  5.55360,  4.53098, 00027420
     1                           3.83589,  3.33368,  2.95145,  2.40778, 00027430
     2                           2.04198,  1.78625,  1.50922,  1.31065, 00027440
     3                           1.16092,  1.01008,   .89594,   .78688, 00027450
     4                            .70239,   .62431,   .56248,   .50506/ 00027460
      DATA(KY1(I,2,6),I=1,20)/   8.99651,  6.14707,  4.68917,  3.79989, 00027470
     1                           3.19938,  2.76592,  2.43794,  1.97336, 00027480
     2                           1.66206,  1.44153,  1.20431,  1.03556, 00027490
     3                            .90917,   .78273,   .68773,   .59762, 00027500
     4                            .52872,   .46473,   .41474,   .36865/ 00027510
      DATA(KY1(I,3,6),I=1,20)/   5.73586,  3.79082,  2.82006,  2.23917, 00027520
     1                           1.85307,  1.57813,  1.37256,  1.08600, 00027530
     2                            .89525,   .75677,   .61116,   .51013, 00027540
     3                            .43610,   .36371,   .31060,   .26140, 00027550
     4                            .22468,   .17133,   .16598,   .14310/ 00027560
      DATA(KY1(I,4,6),I=1,20)/   2.70154,  1.68872,  1.20460,   .92444, 00027570
     1                            .74328,   .61730,   .52503,   .39973, 00027580
     2                            .31803,   .25752,   .19651,   .15607, 00027590
     3                            .12761,   .10092,   .08218,   .06555, 00027600
     4                            .05369,   .04339,   .03587,   .02939/ 00027610
      DATA(KY1(I,5,6),I=1,20)/    .93606,   .54101,   .36376,   .26608, 00027620
     1                            .20543,   .16466,   .13573,   .09789, 00027630
     2                            .07408,   .05647,   .03978,   .02946, 00027640
     3                            .02262,   .01660,   .01264,   .00935, 00027650
     4                            .00716,   .00537,   .00415,   .00317/ 00027660
      DATA(KY1(I,6,6),I=1,20)/    .23720,   .12386,   .07714,   .05303, 00027670
     1                            .03884,   .02974,   .02354,   .01582, 00027680
     2                            .01123,   .00791,   .00503,   .00340, 00027690
     3                            .00241,   .00160,   .00112,   .00075, 00027700
     4                            .00053,   .00036,   .00025,   .00018/ 00027710
      DATA(KY1(I,7,6),I=1,20)/    .04362,   .02010,   .01139,   .00725, 00027720
     1                            .00498,   .00360,   .00271,   .00167, 00027730
     2                            .00109,   .00070,   .00039,   .00024, 00027740
     3                            .00015,   .00009,   .00006,   .00003, 00027750
     4                            .00002,   .00001,   .00001,   .00001/ 00027760
      DATA(KY1(I,8,6),I=1,20)/    .00577,   .00229,   .00116,   .00067, 00027770
     1                            .00043,   .00029,   .00020,   .00011, 00027780
     2                            .00007,   .00004,   .00002,   .00001, 00027790
     3                            .00001,   .00000,   .00000,   .00000, 00027800
     4                            .00000,   .00000,   .00000,   .00000/ 00027810
C                                                                       00027820
C    **** STABILITY CLASS F ****                                        00027830
C                                                                       00027840
      DATA(KY1(I,1,7),I=1,20)/  15.73554, 10.87583,  8.36842,  6.82902, 00027850
     1                           5.78395,  5.02615,  4.45046,  3.63178, 00027860
     2                           3.09680,  2.70230,  2.27611,  1.97151, 00027870
     3                           1.74238,  1.51211,  1.33828,  1.17257, 00027880
     4                           1.04522,   .92635,   .83301,   .74649/ 00027890
      DATA(KY1(I,2,7),I=1,20)/  13.53177,  9.24765,  7.05524,  5.71772, 00027900
     1                           4.81442,  4.16236,  3.66892,  2.97068, 00027910
     2                           2.50927,  2.17290,  1.81191,  1.55574, 00027920
     3                           1.36424,  1.17302,  1.02962,   .89382, 00027930
     4                            .79015,   .69400,   .61900,   .54992/ 00027940
      DATA(KY1(I,3,7),I=1,20)/   8.60228,  5.68285,  4.22606,  3.35451, 00027950
     1                           2.77531,  2.36293,  2.05464,  1.62499, 00027960
     2                           1.33421,  1.12909,   .91354,   .76401, 00027970
     3                            .65445,   .54727,   .46858,   .39563, 00027980
     4                            .34112,   .29162,   .25381,   .21969/ 00027990
      DATA(KY1(I,4,7),I=1,20)/   4.03812,  2.52087,  1.79627,  1.37724, 00028000
     1                           1.10647,   .91827,   .78051,   .59356, 00028010
     2                          .46481,   .37854,   .29123,   .23309, 00028020
     3                          .19201,   .15327,   .12590,   .10148, 00028030
     4                          .08393,   .06858,   .05730,   .04749/ 00028040
      DATA(KY1(I,5,7),I=1,20)/ 1.39716,   .80560,   .54065,   .39434, 00028050
     1                          .30441,   .24372,   .20065,   .14442, 00028060
     2                          .10382,   .08166,   .05854,   .04405, 00028070
     3                          .03435,   .02569,   .01991,   .01504, 00028080
     4                          .01173,   .00900,   .00710,   .00553/ 00028090
      DATA(KY1(I,6,7),I=1,20)/  .35538,   .18495,   .11489,   .07840, 00028100
     1                          .05761,   .04404,   .03479,   .02333, 00028110
     2                          .01569,   .01129,   .00739,   .00514, 00028120
     3                          .00373,   .00257,   .00184,   .00128, 00028130
     4                          .00093,   .00065,   .00048,   .00035/ 00028140
      DATA(KY1(I,7,7),I=1,20)/  .06623,   .03040,   .01717,   .01090, 00028150
     1                          .00747,   .00539,   .00405,   .00249, 00028160
     2                          .00151,   .00100,   .00058,   .00037, 00028170
     3                          .00024,   .00015,   .00010,   .00006, 00028180
     4                          .00004,   .00003,   .00002,   .00001/ 00028190
      DATA(KY1(I,8,7),I=1,20)/  .00901,   .00356,   .00180,   .00104, 00028200
     1                          .00066,   .00045,   .00032,   .00017, 00028210
     2                          .00009,   .00006,   .00003,   .00002, 00028220
     3                          .00001,   .00001,   .00000,   .00000, 00028230
     4                          .00000,   .00000,   .00000,   .00000/ 00028240
C                                                                     00028250
C                                                                     00028260
C   KY2=30 MINUTE AVERAGING TIME                                      00028270
C                                                                     00028280
C   **** STABILITY CLASS A ****                                       00028290
C                                                                     00028300
      DATA(KY2(I,1,1),I=1,20)/ 1.26339,   .88677,   .68983,   .56772, 00028310
     1                          .48419,   .42322,   .37665,   .30998, 00028320
     2                          .26551,   .23287,   .19741,   .17191, 00028330
     3                          .15263,   .13316,   .11839,   .10425, 00028340
     4                          .09332,   .08308,   .07501,   .06749/ 00028350
      DATA(KY2(I,2,1),I=1,20)/ 1.20064,   .83808,   .64916,   .53237, 00028360
     1                          .45265,   .39460,   .35033,   .28710, 00028370
     2                          .24485,   .21393,   .18044,   .15643, 00028380
     3                          .13334,   .12011,   .10633,   .09316, 00028390
     4                          .08303,   .07357,   .06612,   .05922/ 00028400
      DATA(KY2(I,3,1),I=1,20)/ 1.02363,   .70226,   .53672,   .43530, 00028410
     1                          .36650,   .31690,   .27923,   .22583, 00028420
     2                          .19000,   .16404,   .13619,   .11643, 00028430
     3                          .10168,   .08696,   .07594,   .06553, 00028440
     4                          .05760,   .05026,   .04455,   .03931/ 00028450
      DATA(KY2(I,4,1),I=1,20)/  .76596,   .50922,   .37981,   .30189, 00028460
     1                          .24988,   .21272,   .18487,   .14597, 00028470
     2                          .11982,   .10123,   .08166,   .06806, 00028480
     3                          .05810,   .04835,   .04119,   .03457, 00028490
     4                          .02962,   .02515,   .02173,   .01867/ 00028500
      DATA(KY2(I,5,1),I=1,20)/  .48142,   .30433,   .21830,   .16800, 00028510
     1                          .13525,   .11235,   .09551,   .07256, 00028520
     2                          .05726,   .04673,   .03600,   .02881, 00028530
     3                          .02371,   .01888,   .01546,   .01241, 00028540
     4                          .01021,   .00829,   .00688,   .00566/ 00028550
      DATA(KY2(I,6,1),I=1,20)/  .23426,   .13696,   .09247,   .06769, 00028560
     1                          .05219,   .04174,   .03429,   .02454, 00028570
     2                          .01822,   .01409,   .01010,   .00759, 00028580
     3                          .00590,   .00439,   .00338,   .00253, 00028590
     4                          .00196,   .00148,   .00116,   .00089/ 00028600
      DATA(KY2(I,7,1),I=1,20)/  .07567,   .03914,   .02403,   .01626, 00028610
     1                          .01172,   .00883,   .00688,   .00448, 00028620
     2                          .00302,   .00215,   .00138,   .00094, 00028630
     3                          .00067,   .00045,   .00031,   .00021, 00028640
     4                          .00015,   .00010,   .00007,   .00005/ 00028650
```

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      DATA(KY2(I,8,1),I=1,20)/      .01191,    .00504,    .00265,    .00158, 00028660
     1                              .00102,    .00069,    .00050,    .00028, 00028670
     2                              .00016,    .00010,    .00005,    .00003, 00028680
     3                              .00002,    .00001,    .00001,    .00000, 00028690
     4                              .00000,    .00000,    .00000,    .00000/ 00028700
C                                                                            00028710
C   **** STABILITY CLASS B ****                                              00028720
C                                                                            00028730
      DATA(KY2(I,1,2),I=1,20)/     1.92840,   1.34043,   1.03556,    .84771, 00028740
     1                              .71981,    .62686,    .55610,    .45522, 00028750
     2                              .39135,    .34382,    .29208,    .25481, 00028760
     3                              .22658,    .19803,    .17633,    .15552, 00028770
     4                              .13943,    .12431,    .11238,    .10126/ 00028780
      DATA(KY2(I,2,2),I=1,20)/     1.79991,   1.24362,    .95638,    .77997, 00028790
     1                              .66019,    .57333,    .50735,    .41352, 00028800
     2                              .35332,    .30881,    .26054,    .22591, 00028810
     3                              .19778,    .17345,    .15352,    .13449, 00028820
     4                              .11983,    .10612,    .09534,    .08533/ 00028830
      DATA(KY2(I,3,2),I=1,20)/     1.45598,    .98757,    .74886,    .60374, 00028840
     1                              .50604,    .43570,    .38262,    .30775, 00028850
     2                              .25800,    .22194,    .18332,    .15600, 00028860
     3                              .13564,    .11539,    .10027,    .08602, 00028870
     4                              .07520,    .06523,    .05749,    .05042/ 00028880
      DATA(KY2(I,4,2),I=1,20)/     1.00412,    .65939,    .48782,    .38544, 00028890
     1                              .31756,    .26935,    .23338,    .18340, 00028900
     2                              .14372,    .12442,    .09903,    .08154, 00028910
     3                              .06883,    .05650,    .04753,    .03931, 00028920
     4                              .03325,    .02780,    .02370,    .02005/ 00028930
      DATA(KY2(I,5,2),I=1,20)/      .57271,    .35814,    .25526,    .19563, 00028940
     1                              .15705,    .13022,    .11056,    .08398, 00028950
     2                              .06469,    .05189,    .03905,    .03059, 00028960
     3                              .02469,    .01920,    .01539,    .01204, 00028970
     4                              .00968,    .00766,    .00621,    .00498/ 00028980
      DATA(KY2(I,6,2),I=1,20)/      .25697,    .14986,    .10128,    .07432, 00028990
     1                              .05749,    .04615,    .03806,    .02747, 00029000
     2                              .01971,    .01489,    .01034,    .00755, 00029010
     3                              .00572,    .00412,    .00308,    .00222, 00029020
     4                              .00167,    .00122,    .00092,    .00058/ 00029030
      DATA(KY2(I,7,2),I=1,20)/      .08375,    .04430,    .02779,    .01919, 00029040
     1                              .01409,    .01081,    .00856,    .00576, 00029050
     2                              .00374,    .00260,    .00161,    .00107, 00029060
     3                              .00074,    .00048,    .00032,    .00021, 00029070
     4                              .00014,    .00009,    .00006,    .00004/ 00029080
      DATA(KY2(I,8,2),I=1,20)/      .01744,    .00804,    .00455,    .00288, 00029090
     1                              .00197,    .00142,    .00106,    .00065, 00029100
     2                              .00037,    .00023,    .00012,    .00007, 00029110
     3                              .00004,    .00002,    .00001,    .00001, 00029120
     4                              .00000,    .00000,    .00000,    .00000/ 00029130
C                                                                            00029140
C   **** STABILITY CLASS C ****                                              00029150
C                                                                            00029160
      DATA(KY2(I,1,3),I=1,20)/     3.20200,   2.21580,   1.70642,   1.39345, 00029170
     1                             1.18085,   1.02662,    .90939,    .74260, 00029180
     2                              .63933,    .55935,    .47269,    .41057, 00029190
     3                              .36371,    .31651,    .28073,    .24664, 00029200
     4                              .22034,    .19574,    .17637,    .15839/ 00029210
      DATA(KY2(I,2,3),I=1,20)/     2.93887,   2.02025,   1.54803,   1.25896, 00029220
     1                             1.06319,    .92154,    .81412,    .66173, 00029230
     2                              .56530,    .49204,    .41299,    .35658, 00029240
     3                              .31421,    .27169,    .23965,    .20916, 00029250
     4                              .18577,    .16399,    .14692,    .13113/ 00029260
      DATA(KY2(I,3,3),I=1,20)/     2.26570,   1.52643,   1.15195,    .92531, 00029270
     1                              .77326,    .66412,    .58195,    .46641, 00029280
     2                              .38916,    .33348,    .27419,    .23249, 00029290
     3                               .20157,   .17096,   .14820,   .12685, 00029300
     4                               .11070,   .09587,   .08441,   .07395/ 00029310
      DATA(KY2(I,4,3),I=1,20)/      1.45424,   .94666,   .69610,   .54747, 00029320
     1                               .44938,   .37998,   .32837,   .25694, 00029330
     2                               .20595,   .17184,   .13641,   .11215, 00029340
     3                               .09459,   .07762,   .06533,   .05409, 00029350
     4                               .04581,   .03840,   .03282,   .02785/ 00029360
      DATA(KY2(I,5,3),I=1,20)/       .76516,   .47392,   .33562,   .25601, 00029370
     1                               .20476,   .16927,   .14337,   .10835, 00029380
     2                               .08194,   .06578,   .04963,   .03902, 00029390
     3                               .03162,   .02474,   .01995,   .01574, 00029400
     4                               .01276,   .01020,   .00835,   .00677/ 00029410
      DATA(KY2(I,6,3),I=1,20)/       .32242,   .18677,   .12574,   .09204, 00029420
     1                               .07109,   .05701,   .04700,   .03399, 00029430
     2                               .02370,   .01807,   .01273,   .00942, 00029440
     3                               .00724,   .00531,   .00404,   .00299, 00029450
     4                               .00229,   .00171,   .00132,   .00101/ 00029460
      DATA(KY2(I,7,3),I=1,20)/       .10527,   .05592,   .03526,   .02447, 00029470
     1                               .01806,   .01393,   .01108,   .00752, 00029480
     2                               .00473,   .00339,   .00218,   .00150, 00029490
     3                               .00107,   .00072,   .00051,   .00035, 00029500
     4                               .00025,   .00017,   .00012,   .00009/ 00029510
      DATA(KY2(I,8,3),I=1,20)/       .02545,   .01211,   .00703,   .00456, 00029520
     1                               .00318,   .00233,   .00177,   .00112, 00029530
     2                               .00062,   .00041,   .00023,   .00014, 00029540
     3                               .00010,   .00006,   .00004,   .00002, 00029550
     4                               .00001,   .00001,   .00001,   .00000/ 00029560
C                                                                          00029570
C  **** STABILITY CLASS D-DAY ****                                         00029580
C                                                                          00029590
      DATA(KY2(I,1,4),I=1,20)/      5.58162,  3.85000,  2.95813,  2.41128, 00029600
     1                              2.04041,  1.77172,  1.56774,  1.27792, 00029610
     2                              1.10351,   .96594,   .81652,   .70944, 00029620
     3                               .62855,   .54724,   .48560,   .42668, 00029630
     4                               .38128,   .33880,   .30536,   .27429/ 00029640
      DATA(KY2(I,2,4),I=1,20)/      5.09125,  3.43907,  2.66777,  2.16604, 00029650
     1                              1.82673,  1.58162,  1.39593,  1.13294, 00029660
     2                               .96964,   .84394,   .70831,   .61150, 00029670
     3                               .53378,   .46582,   .41083,   .35850, 00029680
     4                               .31837,   .28099,   .25169,   .22460/ 00029690
      DATA(KY2(I,3,4),I=1,20)/      3.85962,  2.59389,  1.95441,  1.56808, 00029700
     1                              1.30926,  1.12369,   .98410,   .78804, 00029710
     2                               .65664,   .56213,   .46158,   .39092, 00029720
     3                               .33855,   .28675,   .24328,   .21221, 00029730
     4                               .18495,   .15994,   .14063,   .12303/ 00029740
      DATA(KY2(I,4,4),I=1,20)/      2.42377,  1.57636,  1.15880,   .91136, 00029750
     1                               .74820,   .63280,   .54701,   .42831, 00029760
     2                               .34117,   .28405,   .22482,   .18436, 00029770
     3                               .15512,   .12692,   .10654,   .08794, 00029780
     4                               .07427,   .06206,   .05289,   .04476/ 00029790
      DATA(KY2(I,5,4),I=1,20)/      1.25394,   .77844,   .55259,   .42248, 00029800
     1                               .33865,   .28052,   .23806,   .18057, 00029810
     2                               .13493,   .10800,   .08114,   .06357, 00029820
     3                               .05134,   .04000,   .03214,   .02525, 00029830
     4                               .02039,   .01623,   .01324,   .01068/ 00029840
      DATA(KY2(I,6,4),I=1,20)/       .53005,   .30970,   .21004,   .15476, 00029850
     1                               .12023,   .09693,   .08030,   .05843, 00029860
     2                               .04017,   .03053,   .02143,   .01582, 00029870
     3                               .01211,   .00885,   .00671,   .00495, 00029880
     4                               .00377,   .00282,   .00217,   .00164/ 00029890
      DATA(KY2(I,7,4),I=1,20)/       .18117,   .09814,   .06288,   .04424, 00029900
     1                               .03306,   .02576,   .02071,   .01431, 00029910
     2                               .00987,   .00632,   .00408,   .00279, 00029920
     3                               .00200,   .00135,   .00095,   .00065, 00029930
     4                                .00046,   .00032,   .00023,   .00016/ 00029940
      DATA(KY2(I,8,4),I=1,20)/        .04939,   .02441,   .01460,   .00972, 00029950
     1                                .00693,   .00518,   .00402,   .00261, 00029960
     2                                .00142,   .00094,   .00055,   .00034, 00029970
     3                                .00023,   .00014,   .00009,   .00006, 00029980
     4                                .00004,   .00002,   .00001,   .00001/ 00029990
C                                                                         00030000
C   **** STABILITY CLASS D-NIGHT ****                                     00030010
C                                                                         00030020
      DATA(KY2(I,1,5),I=1,20)/       5.58162,  3.85000,  2.95813,  2.41128, 00030030
     1                               2.04041,  1.77172,  1.56774,  1.27792, 00030040
     2                               1.10361,   .96584,   .81652,   .70944, 00030050
     3                                .62865,   .54724,   .48560,   .42668, 00030060
     4                                .38128,   .33880,   .30536,   .27429/ 00030070
      DATA(KY2(I,2,5),I=1,20)/       5.09125,  3.48907,  2.66777,  2.16604, 00030080
     1                               1.82678,  1.58162,  1.39593,  1.13284, 00030090
     2                                .96964,   .84394,   .70831,   .61150, 00030100
     3                                .53378,   .46582,   .41083,   .35850, 00030110
     4                                .31837,   .28099,   .25169,   .22460/ 00030120
      DATA(KY2(I,3,5),I=1,20)/       3.85962,  2.59389,  1.95441,  1.56808, 00030130
     1                               1.30926,  1.12369,   .98410,   .78804, 00030140
     2                                .65664,   .56213,   .46158,   .39092, 00030150
     3                                .33855,   .28675,   .24828,   .21221, 00030160
     4                                .18495,   .15994,   .14063,   .12303/ 00030170
      DATA(KY2(I,4,5),I=1,20)/       2.42377,  1.57636,  1.15880,   .91136, 00030180
     1                                .74820,   .63280,   .54701,   .42831, 00030190
     2                                .34117,   .28405,   .22482,   .18436, 00030200
     3                                .15512,   .12692,   .10654,   .08794, 00030210
     4                                .07427,   .06206,   .05289,   .04476/ 00030220
      DATA(KY2(I,5,5),I=1,20)/       1.25384,   .77844,   .55259,   .42248, 00030230
     1                                .33865,   .28052,   .23806,   .18057, 00030240
     2                                .13493,   .10800,   .08114,   .06357, 00030250
     3                                .05134,   .04000,   .03214,   .02525, 00030260
     4                                .02039,   .01623,   .01324,   .01068/ 00030270
      DATA(KY2(I,6,5),I=1,20)/        .53005,   .30970,   .21004,   .15476, 00030280
     1                                .12023,   .09693,   .08030,   .05843, 00030290
     2                                .04017,   .03053,   .02143,   .01582, 00030300
     3                                .01211,   .00885,   .00671,   .00495, 00030310
     4                                .00377,   .00282,   .00217,   .00164/ 00030320
      DATA(KY2(I,7,5),I=1,20)/        .18117,   .09814,   .06288,   .04424, 00030330
     1                                .03306,   .02576,   .02071,   .01431, 00030340
     2                                .00897,   .00632,   .00408,   .00279, 00030350
     3                                .00290,   .00135,   .00095,   .00065, 00030360
     4                                .00046,   .00032,   .00023,   .00016/ 00030370
      DATA(KY2(I,8,5),I=1,20)/        .04939,   .02441,   .01460,   .00972, 00030380
     1                                .00693,   .00518,   .00402,   .00261, 00030390
     2                                .00142,   .00094,   .00055,   .00034, 00030400
     3                                .00023,   .00014,   .00009,   .00006, 00030410
     4                                .00004,   .00002,   .00001,   .00001/ 00030420
C                                                                         00030430
C   **** STABILITY CLASS E ****                                           00030440
C                                                                         00030450
      DATA(KY2(I,1,6),I=1,20)/       8.62219,  5.95693,  4.58224,  3.73849, 00030460
     1                               3.16580,  2.75060,  2.43522,  1.98631, 00030470
     2                               1.68483,  1.47382,  1.24525,  1.08141, 00030480
     3                                .95737,   .83341,   .73924,   .64925, 00030490
     4                                .57995,   .51511,   .46410,   .41672/ 00030500
      DATA(KY2(I,2,6),I=1,20)/       7.78646,  5.33912,  4.08372,  3.31642, 00030510
     1                               2.79744,  2.42230,  2.13809,  1.73532, 00030520
     2                               1.46451,  1.27366,  1.06790,   .92117, 00030530
     3                                .81103,   .70059,   .61743,   .53836, 00030540
     4                                .47775,   .42134,   .37716,   .33633/ 00030550
      DATA(KY2(I,3,6),I=1,20)/       5.73144,  3.84195,  2.88877,  2.31369, 00030560
     1                               1.92884,  1.65319,  1.44603,  1.15539, 00030570
     2                           .96139,   .82135,   .67295,   .56886, 00030580
     3                           .49135,   .41579,   .35940,   .30661, 00030590
     4                           .26680,   .23031,   .20219,   .17660/ 00030600
      DATA(KY2(I,4,6),I=1,20)/  3.43286,  2.21552,  1.61891,  1.26690, 00030610
     1                          1.03563,   .87258,   .75172,   .58510, 00030620
     2                           .47308,   .39430,   .31082,   .25400, 00030630
     3                           .21306,   .17371,   .14536,   .11957, 00030640
     4                           .10068,   .08386,   .07126,   .06012/ 00030650
      DATA(KY2(I,5,6),I=1,20)/  1.66836,  1.02077,   .71647,   .54267, 00030660
     1                           .43151,   .35492,   .29929,   .22452, 00030670
     2                           .17620,   .14034,   .10473,   .08164, 00030680
     3                           .06562,   .05084,   .04065,   .03176, 00030690
     4                           .02554,   .02022,   .01642,   .01319/ 00030700
      DATA(KY2(I,6,6),I=1,20)/   .65527,   .37414,   .24927,   .18098, 00030710
     1                           .13385,   .11070,   .09080,   .06493, 00030720
     2                           .04876,   .03682,   .02562,   .01877, 00030730
     3                           .01427,   .01035,   .00780,   .00571, 00030740
     4                           .00432,   .00321,   .00245,   .00185/ 00030750
      DATA(KY2(I,7,6),I=1,20)/   .20690,   .10848,   .06777,   .04671, 00030760
     1                           .03428,   .02630,   .02085,   .01406, 00030770
     2                           .01030,   .00707,   .00451,   .00306, 00030780
     3                           .00217,   .00145,   .00102,   .00069, 00030790
     4                           .00048,   .00033,   .00023,   .00016/ 00030800
      DATA(KY2(I,8,6),I=1,20)/   .05218,   .02471,   .01429,   .00926, 00030810
     1                           .00644,   .00472,   .00359,   .00226, 00030820
     2                           .00150,   .00098,   .00057,   .00035, 00030830
     3                           .00023,   .00014,   .00009,   .00005, 00030840
     4                           .00004,   .00002,   .00001,   .00001/ 00030850
C                                                                      00030860
C   **** STABILITY CLASS F ****                                        00030870
C                                                                      00030880
      DATA(KY2(I,1,7),I=1,20)/ 12.58331,  8.97359,  6.90474,  5.63459, 00030890
     1                          4.77230,  4.14705,  3.67205,  2.99657, 00030900
     2                          2.55516,  2.22965,  1.87801,  1.62668, 00030910
     3                          1.43763,  1.24764,  1.10421,   .96748, 00030920
     4                           .86241,   .76433,   .68731,   .61593/ 00030930
      DATA(KY2(I,2,7),I=1,20)/ 11.71591,  8.33560,  6.14723,  4.99236, 00030940
     1                          4.21195,  3.64742,  3.21969,  2.61346, 00030950
     2                          2.21420,  1.92208,  1.60791,  1.33445, 00030960
     3                          1.21706,  1.04957,   .92370,   .80424, 00030970
     4                           .71285,   .62791,   .56152,   .50023/ 00030980
      DATA(KY2(I,3,7),I=1,20)/  8.60673,  5.76842,  4.33665,  3.47284, 00030990
     1                          2.89479,  2.48079,  2.16966,  1.73319, 00031000
     2                          1.44033,  1.23089,  1.00877,   .85315, 00031010
     3                           .73813,   .62460,   .54048,   .46176, 00031020
     4                           .40239,   .34798,   .30603,   .26785/ 00031030
      DATA(KY2(I,4,7),I=1,20)/  5.14335,  3.31638,  2.42215,  1.89444, 00031040
     1                          1.54787,  1.30359,  1.12259,   .87314, 00031050
     2                           .70259,   .58493,   .46322,   .38022, 00031060
     3                           .32031,   .26261,   .22091,   .18237, 00031070
     4                           .15490,   .12990,   .11111,   .09441/ 00031080
      DATA(KY2(I,5,7),I=1,20)/  2.49719,  1.52564,  1.06955,   .80928, 00031090
     1                           .64293,   .52839,   .44525,   .33357, 00031100
     2                           .25655,   .20589,   .15539,   .12231, 00031110
     3                           .09926,   .07784,   .06294,   .04934, 00031120
     4                           .04057,   .03259,   .02680,   .02185/ 00031130
      DATA(KY2(I,6,7),I=1,20)/   .99330,   .56027,   .37264,   .27316, 00031140
     1                           .20700,   .16485,   .13507,   .09642, 00031150
     2                           .06995,   .05354,   .03798,   .02832, 00031160
     3                           .02190,   .01622,   .01246,   .00932, 00031170
     4                           .00721,   .00547,   .00428,   .00331/ 00031180
      DATA(KY2(I,7,7),I=1,20)/   .31330,   .16386,   .10217,   .07029, 00031190
     1                           .05152,   .03947,   .03125,   .02102, 00031200
     2                           .01420,   .01025,   .00674,   .00470, 00031210
     3                            .00343,   .00237,   .00171,   .00119, 00031220
     4                            .00096,   .00061,   .00045,   .00033/ 00031230
      DATA(KY2(I,8,7),I=1,20)/    .08054,   .03805,   .02198,   .01421, 00031240
     1                            .00988,   .00723,   .00549,   .00344, 00031250
     2                            .00214,   .00144,   .00086,   .00056, 00031260
     3                            .00038,   .00024,   .00016,   .00010, 00031270
     4                            .00007,   .00005,   .00003,   .00002/ 00031280
C                                                                       00031290
C                                                                       00031300
C  KY3 = 1 HOUR AVERAGING TIME                                          00031310
C                                                                       00031320
C  **** STABILITY CLASS A ****                                          00031330
C                                                                       00031340
      DATA(KY3(I,1,1),I=1,20)/    .79130,   .55541,   .43206,   .35558, 00031350
     1                            .30326,   .26508,   .23591,   .19415, 00031360
     2                            .16630,   .14585,   .12364,   .10767, 00031370
     3                            .09560,   .08340,   .07415,   .06529, 00031380
     4                            .05845,   .05204,   .04698,   .04227/ 00031390
      DATA(KY3(I,2,1),I=1,20)/    .76683,   .53640,   .41617,   .34176, 00031400
     1                            .29093,   .25387,   .22560,   .18519, 00031410
     2                            .15820,   .13842,   .11698,   .10159, 00031420
     3                            .08997,   .07826,   .06940,   .06092, 00031430
     4                            .05439,   .04828,   .04347,   .03900/ 00031440
      DATA(KY3(I,3,1),I=1,20)/    .69331,   .47970,   .36904,   .30094, 00031450
     1                            .25463,   .22102,   .19548,   .15912, 00031460
     2                            .13477,   .11704,   .09792,   .08429, 00031470
     3                            .07407,   .06382,   .05610,   .04878, 00031480
     4                            .04317,   .03795,   .03387,   .03010/ 00031490
      DATA(KY3(I,4,1),I=1,20)/    .57167,   .38735,   .29320,   .23591, 00031500
     1                            .19732,   .16954,   .14858,   .11902, 00031510
     2                            .09917,   .08489,   .06968,   .05898, 00031520
     3                            .05104,   .04318,   .03734,   .03187, 00031530
     4                            .02773,   .02394,   .02101,   .01834/ 00031540
      DATA(KY3(I,5,1),I=1,20)/    .40355,   .26692,   .19642,   .15439, 00031550
     1                            .12657,   .10684,   .09215,   .07179, 00031560
     2                            .05813,   .04853,   .03853,   .03166, 00031570
     3                            .02669,   .02187,   .01838,   .01519, 00031580
     4                            .01284,   .01073,   .00915,   .00774/ 00031590
      DATA(KY3(I,6,1),I=1,20)/    .22619,   .13859,   .09704,   .07320, 00031600
     1                            .05793,   .04739,   .03975,   .02949, 00031610
     2                            .02271,   .01813,   .01358,   .01060, 00031620
     3                            .00852,   .00661,   .00528,   .00412, 00031630
     4                            .00331,   .00261,   .00212,   .00169/ 00031640
      DATA(KY3(I,7,1),I=1,20)/    .07379,   .04004,   .02552,   .01781, 00031650
     1                            .01318,   .01016,   .00808,   .00546, 00031660
     2                            .00383,   .00281,   .00188,   .00133, 00031670
     3                            .00098,   .00068,   .00050,   .00035, 00031680
     4                            .00025,   .00018,   .00013,   .00010/ 00031690
      DATA(KY3(I,8,1),I=1,20)/    .00636,   .00265,   .00137,   .00081, 00031700
     1                            .00052,   .00035,   .00025,   .00014, 00031710
     2                            .00008,   .00005,   .00002,   .00001, 00031720
     3                            .00001,   .00000,   .00000,   .00000, 00031730
     4                            .00000,   .00000,   .00000,   .00000/ 00031740
C                                                                       00031750
C  **** STABILITY CLASS B ****                                          00031760
C                                                                       00031770
      DATA(KY3(I,1,2),I=1,20)/   1.31714,   .91554,   .70731,   .57900, 00031780
     1                            .49165,   .42816,   .37982,   .31092, 00031790
     2                            .26730,   .23484,   .19950,   .17404, 00031800
     3                            .15476,   .13526,   .12044,   .10622, 00031810
     4                            .09523,   .08491,   .07676,   .06916/ 00031820
      DATA(KY3(I,2,2),I=1,20)/   1.24811,   .86350,   .66472,   .54256, 00031830
     1                            .45956,   .39934,   .35357,   .28846, 00031840
     2                            .24680,   .21595,   .18247,   .15843, 00031850
     3                               .14027,   .12197,   .10810,   .09483, 00031860
     4                               .08461,   .07504,   .06751,   .06051/ 00031870
      DATA(KY3(I,3,2),I=1,20)/      1.05475,   .71910,   .54741,   .44274, 00031880
     1                               .37211,   .32115,   .28262,   .22816, 00031890
     2                               .19229,   .16614,   .13804,   .11898, 00031900
     3                               .10316,   .08825,   .07708,   .06651, 00031910
     4                               .05845,   .05079,   .04519,   .03985/ 00031920
      DATA(KY3(I,4,2),I=1,20)/       .77727,   .51602,   .38494,   .30622, 00031930
     1                               .25376,   .21632,   .18828,   .14912, 00031940
     2                               .12229,   .10327,   .08323,   .06930, 00031950
     3                               .05908,   .04908,   .04175,   .03496, 00031960
     4                               .02939,   .02531,   .02182,   .01868/ 00031970
      DATA(KY3(I,5,2),I=1,20)/       .47763,   .30392,   .21951,   .17007, 00031980
     1                               .13779,   .11517,   .09850,   .07567, 00031990
     2                               .05941,   .04837,   .03713,   .02961, 00032000
     3                               .02428,   .01925,   .01570,   .01253, 00032010
     4                               .01026,   .00828,   .00683,   .00558/ 00032020
      DATA(KY3(I,6,2),I=1,20)/       .22540,   .13434,   .09231,   .06866, 00032030
     1                               .05374,   .04357,   .03627,   .02658, 00032040
     2                               .01951,   .01502,   .01069,   .00798, 00032050
     3                               .00616,   .00455,   .00347,   .00257, 00032060
     4                               .00197,   .00148,   .00114,   .00087/ 00032070
      DATA(KY3(I,7,2),I=1,20)/       .07006,   .03772,   .02396,   .01674, 00032080
     1                               .01241,   .00960,   .00766,   .00522, 00032090
     2                               .00345,   .00243,   .00154,   .00104, 00032100
     3                               .00073,   .00048,   .00033,   .00022, 00032110
     4                               .00015,   .00010,   .00007,   .00005/ 00032120
      DATA(KY3(I,8,2),I=1,20)/       .01055,   .00483,   .00271,   .00171, 00032130
     1                               .00116,   .00083,   .00062,   .00037, 00032140
     2                               .00021,   .00013,   .00007,   .00004, 00032150
     3                               .00002,   .00001,   .00001,   .00000, 00032160
     4                               .00000,   .00000,   .00000,   .00000/ 00032170
C                                                                          00032180
C  **** STABILITY CLASS C ****                                             00032190
C                                                                          00032200
      DATA(KY3(I,1,3),I=1,20)/      2.38498,  1.65042,  1.27101,  1.03790, 00032210
     1                               .87955,   .76466,   .67735,   .55312, 00032220
     2                               .47620,   .41663,   .35208,   .30581, 00032230
     3                               .27091,   .23575,   .20914,   .13371, 00032240
     4                               .16412,   .14579,   .13137,   .11797/ 00032250
      DATA(KY3(I,2,3),I=1,20)/      2.20846,  1.51919,  1.16469,   .94760, 00032260
     1                               .80054,   .69409,   .61336,   .49879, 00032270
     2                               .42644,   .37137,   .31193,   .26949, 00032280
     3                               .23760,   .20558,   .18144,   .15846, 00032290
     4                               .14083,   .12440,   .11152,   .09960/ 00032300
      DATA(KY3(I,3,3),I=1,20)/      1.74614,  1.17950,   .89192,   .71760, 00032310
     1                               .60051,   .51637,   .45297,   .36370, 00032320
     2                               .30441,   .26138,   .21550,   .18316, 00032330
     3                               .15914,   .13531,   .11757,   .10039, 00032340
     4                               .08825,   .07661,   .06761,   .05938/ 00032350
      DATA(KY3(I,4,3),I=1,20)/      1.16350,   .76161,   .56238,   .44380, 00032360
     1                               .36535,   .30970,   .26824,   .21070, 00032370
     2                               .16998,   .14244,   .11372,   .09396, 00032380
     3                               .07960,   .06567,   .05554,   .04623, 00032390
     4                               .03934,   .03315,   .02847,   .02429/ 00032400
      DATA(KY3(I,5,3),I=1,20)/       .63813,   .39872,   .28424,   .21799, 00032410
     1                               .17515,   .14537,   .12356,   .09395, 00032420
     2                               .07178,   .05802,   .04417,   .03500, 00032430
     3                               .02856,   .02253,   .01831,   .01457, 00032440
     4                               .01191,   .00960,   .00792,   .00647/ 00032450
      DATA(KY3(I,6,3),I=1,20)/       .27759,   .16261,   .11041,   .08138, 00032460
     1                               .06323,   .05096,   .04220,   .03068, 00032470
     2                               .02174,   .01671,   .01191,   .00891, 00032480
     3                               .00690,   .00512,   .00393,   .00294, 00032490
     4                                .00227,   .00172,   .00134,   .00103/ 00032500
      DATA(KY3(I,7,3),I=1,20)/        .09058,   .04865,   .03094,   .02162, 00032510
     1                                .01605,   .01244,   .00995,   .00680, 00032520
     2                                .00436,   .00313,   .00204,   .00141, 00032530
     3                                .00102,   .00070,   .00050,   .00034, 00032540
     4                                .00024,   .00017,   .00012,   .00009/ 00032550
      DATA(KY3(I,8,3),I=1,20)/        .02041,   .00977,   .00569,   .00370, 00032560
     1                                .00259,   .00190,   .00145,   .00092, 00032570
     2                                .00051,   .00034,   .00020,   .00012, 00032580
     3                                .00008,   .00005,   .00003,   .00002, 00032590
     4                                .00001,   .00001,   .00001,   .00000/ 00032600
C                                                                         00032610
C   **** STABILITY CLASS D-DAY ****                                       00032620
C                                                                         00032630
      DATA(KY3(I,1,4),I=1,20)/       4.53368,  3.12717,  2.40275,  1.95857, 00032640
     1                               1.65733,  1.43908,  1.27340,  1.03799, 00032650
     2                                .89641,   .78451,   .66322,   .57624, 00032660
     3                                .51063,   .44450,   .39443,   .34657, 00032670
     4                                .30970,   .27519,   .24803,   .22279/ 00032680
      DATA(KY3(I,2,4),I=1,20)/       4.13758,  2.83562,  2.16820,  1.76046, 00032690
     1                               1.48476,  1.28552,  1.13461,   .92079, 00032700
     2                                .78818,   .68603,   .57580,   .49712, 00032710
     3                                .43802,   .37871,   .33402,   .29149, 00032720
     4                                .25887,   .22848,   .20467,   .18264/ 00032730
      DATA(KY3(I,3,4),I=1,20)/       3.13996,  2.11047,  1.59030,  1.27603, 00032740
     1                               1.06548,   .91451,   .80094,   .64141, 00032750
     2                                .53455,   .45766,   .37584,   .31834, 00032760
     3                                .27572,   .23356,   .20224,   .17238, 00032770
     4                                .15070,   .13033,   .11461,   .10027/ 00032780
      DATA(KY3(I,4,4),I=1,20)/       1.97165,  1.28244,   .94281,   .74154, 00032790
     1                                .60882,   .51493,   .44515,   .36856, 00032800
     2                                .27769,   .23122,   .18304,   .15011, 00032810
     3                                .12631,   .10336,   .08677,   .07163, 00032820
     4                                .06050,   .05056,   .04310,   .03647/ 00032830
      DATA(KY3(I,5,4),I=1,20)/       1.01574,   .63050,   .44751,   .34210, 00032840
     1                                .27419,   .22711,   .19272,   .14616, 00032850
     2                                .10919,   .08738,   .06564,   .05141, 00032860
     3                                .04151,   .03234,   .02598,   .02040, 00032870
     4                                .01648,   .01311,   .01069,   .00863/ 00032880
      DATA(KY3(I,6,4),I=1,20)/        .42406,   .24751,   .16773,   .12350, 00032890
     1                                .09590,   .07727,   .06399,   .04653, 00032900
     2                                .03194,   .02426,   .01701,   .01254, 00032910
     3                                .00959,   .00700,   .00531,   .00390, 00032920
     4                                .00297,   .00222,   .00171,   .00129/ 00032930
      DATA(KY3(I,7,4),I=1,20)/        .14110,   .07621,   .04872,   .03422, 00032940
     1                                .02553,   .01987,   .01595,   .01100, 00032950
     2                                .00679,   .00483,   .00310,   .00212, 00032960
     3                                .00151,   .00102,   .00072,   .00049, 00032970
     4                                .00034,   .00024,   .00017,   .00012/ 00032980
      DATA(KY3(I,8,4),I=1,20)/        .03662,   .01798,   .01070,   .00709, 00032990
     1                                .00504,   .00376,   .00291,   .00188, 00033000
     2                                .00102,   .00067,   .00039,   .00024, 00033010
     3                                .00016,   .00010,   .00006,   .00004, 00033020
     4                                .00002,   .00002,   .00001,   .00001/ 00033030
C                                                                         00033040
C   **** STABILITY CLASS D-NIGHT ****                                     00033050
C                                                                         00033060
      DATA(KY3(I,1,5),I=1,20)/       4.53368,  3.12717,  2.40275,  1.95857, 00033070
     1                               1.65733,  1.43908,  1.27340,  1.03799, 00033080
     2                                .89641,   .78451,   .66322,   .57624, 00033090
     3                                .51063,   .44450,   .39443,   .34657, 00033100
     4                                .30970,   .27519,   .24803,   .22279/ 00033110
      DATA(KY3(I,2,5),I=1,20)/       4.13758,  2.83562,  2.16820,  1.76046, 00033120
     1                               1.48476,  1.28552,  1.13461,   .92079, 00033130
     2                       .78818,   .68603,   .57580,   .49712, 00033140
     3                       .43802,   .37871,   .33402,   .29149, 00033150
     4                       .25887,   .22848,   .20467,   .19264/ 00033160
      DATA(KY3(I,3,5),I=1,20)/  3.13996,  2.11047,  1.59030,  1.27603, 00033170
     1                      1.06548,   .91451,   .80094,   .64141, 00033180
     2                       .53455,   .45766,   .37584,   .31834, 00033190
     3                       .27572,   .23356,   .20224,   .17288, 00033200
     4                       .15070,   .13033,   .11461,   .10027/ 00033210
      DATA(KY3(I,4,5),I=1,20)/  1.97165,  1.28244,   .94281,   .74154, 00033220
     1                       .60382,   .51493,   .44515,   .34858, 00033230
     2                       .27769,   .23122,   .18304,   .15011, 00033240
     3                       .12631,   .10336,   .08677,   .07163, 00033250
     4                       .06050,   .05056,   .04310,   .03647/ 00033260
      DATA(KY3(I,5,5),I=1,20)/  1.01574,   .63050,   .44751,   .34210, 00033270
     1                       .27419,   .22711,   .19272,   .14616, 00033280
     2                       .10919,   .08738,   .06564,   .05141, 00033290
     3                       .04151,   .03234,   .02598,   .02040, 00033300
     4                       .01648,   .01311,   .01069,   .00863/ 00033310
      DATA(KY3(I,6,5),I=1,20)/   .42406,   .24751,   .16773,   .12350, 00033320
     1                       .09590,   .07727,   .06399,   .04653, 00033330
     2                       .03194,   .02426,   .01791,   .01254, 00033340
     3                       .00959,   .00700,   .00531,   .00390, 00033350
     4                       .00297,   .00222,   .00171,   .00129/ 00033360
      DATA(KY3(I,7,5),I=1,20)/   .14110,   .07621,   .04872,   .03422, 00033370
     1                       .02553,   .01987,   .01595,   .01100, 00033380
     2                       .00679,   .00483,   .00310,   .00212, 00033390
     3                       .00151,   .00102,   .00072,   .00049, 00033400
     4                       .00034,   .00024,   .00017,   .00012/ 00033410
      DATA(KY3(I,8,5),I=1,20)/   .03652,   .01798,   .01070,   .00709, 00033420
     1                       .00504,   .00376,   .00291,   .00188, 00033430
     2                       .00102,   .00067,   .00039,   .00024, 00033440
     3                       .00016,   .00010,   .00006,   .00004, 00033450
     4                       .00002,   .00002,   .00001,   .00001/ 00033460
C                                                                  00033470
C     **** STABILITY CLASS E ****                                  00033480
C                                                                  00033490
      DATA(KY3(I,1,6),I=1,20)/  7.63726,  5.27645,  4.05880,  3.31143, 00033500
     1                      2.80416,  2.43639,  2.15704,  1.75985, 00033510
     2                      1.49237,  1.30547,  1.10300,   .95798, 00033520
     3                       .84845,   .73821,   .65479,   .57509, 00033530
     4                       .51370,   .45627,   .41109,   .36912/ 00033540
      DATA(KY3(I,2,6),I=1,20)/  6.89145,  4.72513,  3.61394,  2.93431, 00033550
     1                      2.47546,  2.14344,  1.89191,  1.53545, 00033560
     2                      1.29578,  1.12687,   .94476,   .81491, 00033570
     3                       .71744,   .61971,   .54612,   .47616, 00033580
     4                       .42253,   .37261,   .33353,   .29740/ 00033590
      DATA(KY3(I,3,6),I=1,20)/  5.05959,  3.39072,  2.54902,  2.04127, 00033600
     1                      1.70151,  1.45818,  1.27533,  1.01892, 00033610
     2                       .84735,   .72401,   .59305,   .50120, 00033620
     3                       .43326,   .36617,   .31645,   .26991, 00033630
     4                       .23481,   .20265,   .17787,   .15532/ 00033640
      DATA(KY3(I,4,6),I=1,20)/  3.01579,  1.94517,  1.42071,  1.11138, 00033650
     1                       .90821,   .76501,   .65889,   .51263, 00033660
     2                       .41608,   .34516,   .27192,   .22209, 00033670
     3                       .18620,   .15172,   .12690,   .10433, 00033680
     4                       .08779,   .07308,   .06207,   .05234/ 00033690
      DATA(KY3(I,5,6),I=1,20)/  1.45402,   .88857,   .62311,   .47161, 00033700
     1                       .37476,   .30809,   .25968,   .19464, 00033710
     2                       .15264,   .12146,   .09057,   .07049, 00033720
     3                       .05660,   .04381,   .03499,   .02731, 00033730
     4                       .02193,   .01735,   .01407,   .01129/ 00033740
      DATA(KY3(I,6,6),I=1,20)/   .56410,   .32141,   .21379,   .15503, 00033750
     1                       .11881,   .09463,   .07755,   .05538, 00033760
     2                       .04153,   .03131,   .02174,   .01589, 00033770
     3                               .01207,   .00874,   .00657,   .00480, 00033780
     4                               .00362,   .00268,   .00205,   .00154/ 00033790
      DATA(KY3(I,7,6),I=1,20)/       .17489,   .09138,   .05694,   .03916, 00033800
     1                               .02869,   .02198,   .01740,   .01170, 00033810
     2                               .00830,   .00586,   .00372,   .00252, 00033820
     3                               .00178,   .00119,   .00083,   .00056, 00033830
     4                               .00039,   .00027,   .00019,   .00013/ 00033840
      DATA(KY3(I,8,6),I=1,20)/       .04296,   .02023,   .01166,   .00752, 00033850
     1                               .00522,   .00382,   .00290,   .00182, 00033860
     2                               .00121,   .00078,   .00045,   .00028, 00033870
     3                               .00018,   .00011,   .00007,   .00004, 00033880
     4                               .00003,   .00002,   .00001,   .00001/ 00033890
C                                                                          00033900
C   **** STABILITY CLASS F ****                                            00033910
C                                                                          00033920
      DATA(KY3(I,1,7),I=1,20)/     11.50019,  7.94852,  6.11599,  4.99093, 00033930
     1                              4.22715,  3.67332,  3.25258,  2.65426, 00033940
     2                              2.26327,  1.97495,  1.66348,  1.44086, 00033950
     3                              1.27340,  1.10512,   .97807,   .85696, 00033960
     4                               .76389,   .67702,   .60880,   .54557/ 00033970
      DATA(KY3(I,2,7),I=1,20)/     10.43166,  7.15755,  5.47714,  4.44966, 00033980
     1                              3.75447,  3.25183,  2.87094,  2.33100, 00033990
     2                              1.97554,  1.71535,  1.43547,  1.23635, 00034000
     3                              1.08716,   .93785,   .82560,   .71906, 00034010
     4                               .63753,   .56175,   .50249,   .44778/ 00034020
      DATA(KY3(I,3,7),I=1,20)/      7.78347,  5.22476,  3.93254,  3.15222, 00034030
     1                              2.62966,  2.25515,  1.97355,  1.57824, 00034040
     2                              1.31327,  1.12348,   .92201,   .78072, 00034050
     3                               .67619,   .57292,   .49632,   .42458, 00034060
     4                               .37041,   .32072,   .28238,   .24744/ 00034070
      DATA(KY3(I,4,7),I=1,20)/      4.77297,  3.08878,  2.26151,  1.77259, 00034080
     1                              1.45092,  1.22387,  1.05542,   .82287, 00034090
     2                               .66408,   .55418,   .44023,   .36233, 00034100
     3                               .30598,   .25157,   .21217,   .17614, 00034110
     4                               .14958,   .12579,   .10786,   .09189/ 00034120
      DATA(KY3(I,5,7),I=1,20)/      2.40199,  1.47656,  1.03997,   .78988, 00034130
     1                               .62953,   .51882,   .43827,   .32975, 00034140
     2                               .25492,   .20544,   .15591,   .12330, 00034150
     3                               .10049,   .07921,   .06434,   .05121, 00034160
     4                               .04187,   .03380,   .02792,   .02287/ 00034170
      DATA(KY3(I,6,7),I=1,20)/       .99000,   .56951,   .38154,   .27825, 00034180
     1                               .21426,   .17137,   .14095,   .10129, 00034190
     2                               .07408,   .05707,   .04083,   .03067, 00034200
     3                               .02386,   .01782,   .01379,   .01039, 00034210
     4                               .00809,   .00620,   .00488,   .00380/ 00034220
      DATA(KY3(I,7,7),I=1,20)/       .33330,   .17673,   .11134,   .07724, 00034230
     1                               .05702,   .04395,   .03499,   .02376, 00034240
     2                               .01623,   .01184,   .00787,   .00555, 00034250
     3                               .00409,   .00285,   .00208,   .00147, 00034260
     4                               .00108,   .00077,   .00057,   .00042/ 00034270
      DATA(KY3(I,8,7),I=1,20)/       .09136,   .04397,   .02575,   .01683, 00034280
     1                               .01182,   .00872,   .00668,   .00424, 00034290
     2                               .00267,   .00182,   .00111,   .00073, 00034300
     3                               .00050,   .00032,   .00022,   .00014, 00034310
     4                               .00010,   .00006,   .00004,   .00003/ 00034320
C                                                                          00034330
C                                                                          00034340
C   KY4 = 3 HOUR AVERAGING TIME                                            00034350
C                                                                          00034360
C   **** STABILITY CLASS A ****                                            00034370
C                                                                          00034380
      DATA(KY4(I,1,1),I=1,20)/       .37695,   .26458,   .20582,   .16939, 00034390
     1                               .14446,   .12627,   .11238,   .09249, 00034400
     2                               .07922,   .06948,   .05890,   .05129, 00034410
     3                                  .04554,   .03973,   .03532,   .03110, 00034420
     4                                  .02784,   .02479,   .02238,   .02014/ 00034430
      DATA(KY4(I,2,1),I=1,20)/          .37300,   .26151,   .20325,   .16715, 00034440
     1                                  .14247,   .12446,   .11071,   .09103, 00034450
     2                                  .07790,   .06827,   .05781,   .05030, 00034460
     3                                  .04462,   .03889,   .03455,   .03039, 00034470
     4                                  .02718,   .02417,   .02180,   .01960/ 00034480
      DATA(KY4(I,3,1),I=1,20)/          .36020,   .25158,   .19496,   .15994, 00034490
     1                                  .13604,   .11862,   .10534,   .08637, 00034500
     2                                  .07370,   .06442,   .05436,   .04715, 00034510
     3                                  .04171,   .03624,   .03209,   .02814, 00034520
     4                                  .02509,   .02224,   .02000,   .01792/ 00034530
      DATA(KY4(I,4,1),I=1,20)/          .33529,   .23237,   .17899,   .14611, 00034540
     1                                  .12374,   .10750,   .09514,   .07754, 00034550
     2                                  .06576,   .05717,   .04790,   .04129, 00034560
     3                                  .03632,   .03134,   .02759,   .02402, 00034570
     4                                  .02129,   .01874,   .01675,   .01491/ 00034580
      DATA(KY4(I,5,1),I=1,20)/          .29131,   .19884,   .15136,   .12236, 00034590
     1                                  .10276,   .08861,   .07790,   .06275, 00034600
     2                                  .05259,   .04524,   .03738,   .03183, 00034610
     3                                  .02769,   .02358,   .02051,   .01762, 00034620
     4                                  .01542,   .01340,   .01183,   .01039/ 00034630
      DATA(KY4(I,6,1),I=1,20)/          .21563,   .14245,   .10573,   .08370, 00034640
     1                                  .06904,   .05859,   .05078,   .03990, 00034650
     2                                  .03259,   .02742,   .02199,   .01824, 00034660
     3                                  .01549,   .01282,   .01087,   .00907, 00034670
     4                                  .00774,   .00653,   .00562,   .00480/ 00034680
      DATA(KY4(I,7,1),I=1,20)/          .09716,   .05887,   .04086,   .03060, 00034690
     1                                  .02407,   .01958,   .01634,   .01202, 00034700
     2                                  .00918,   .00727,   .00539,   .00417, 00034710
     3                                  .00333,   .00255,   .00202,   .00156, 00034720
     4                                  .00124,   .00097,   .00078,   .00062/ 00034730
      DATA(KY4(I,8,1),I=1,20)/          .00316,   .00132,   .00069,   .00041, 00034740
     1                                  .00026,   .00018,   .00013,   .00007, 00034750
     2                                  .00004,   .00002,   .00001,   .00001, 00034760
     3                                  .00000,   .00000,   .00000,   .00000, 00034770
     4                                  .00000,   .00000,   .00000,   .00000/ 00034780
**** STABILITY CLASS B  ****                                                  00034790
                                                                              00034800
                                                                              00034810
      DATA(KY4(I,1,2),I=1,20)/          .71980,   .50033,   .38654,   .31642, 00034820
     1                                  .26868,   .23398,   .20757,   .16992, 00034830
     2                                  .14608,   .12834,   .10902,   .09511, 00034840
     3                                  .08458,   .07392,   .06582,   .05805, 00034850
     4                                  .05204,   .04640,   .04195,   .03780/ 00034860
      DATA(KY4(I,2,2),I=1,20)/          .70008,   .48545,   .37434,   .30598, 00034870
     1                                  .25948,   .22572,   .20004,   .16347, 00034880
     2                                  .14018,   .12290,   .10412,   .09061, 00034890
     3                                  .08039,   .07007,   .06225,   .05475, 00034900
     4                                  .04896,   .04354,   .03926,   .03528/ 00034910
      DATA(KY4(I,3,2),I=1,20)/          .64010,   .44040,   .33760,   .27460, 00034920
     1                                  .23191,   .20101,   .17756,   .14429, 00034930
     2                                  .12275,   .10690,   .08975,   .07749, 00034940
     3                                  .06826,   .05899,   .05200,   .04533, 00034950
     4                                  .04022,   .03545,   .03171,   .02825/ 00034960
      DATA(KY4(I,4,2),I=1,20)/          .53833,   .36484,   .27648,   .22279, 00034970
     1                                  .18665,   .16065,   .14103,   .11337, 00034980
     2                                  .09496,   .08163,   .06736,   .05727, 00034990
     3                                  .04976,   .04229,   .03672,   .03147, 00035000
     4                                  .02749,   .02382,   .02098,   .01838/ 00035010
      DATA(KY4(I,5,2),I=1,20)/          .39622,   .26145,   .19414,   .15386, 00035020
     1                                  .12709,   .10803,   .09380,   .07397, 00035030
     2                                  .06028,   .05064,   .04053,   .03354, 00035040
     3                                  .02843,   .02347,   .01984,   .01650, 00035050
     4                            .01402,   .01179,   .01010,   .00859/ 00035060
      DATA(KY4(I,6,2),I=1,20)/    .22776,   .14321,   .10251,   .07883, 00035070
     1                            .06347,   .05276,   .04490,   .03420, 00035080
     2                            .02652,   .02138,   .01619,   .01276, 00035090
     3                            .01035,   .00810,   .00652,   .00514, 00035100
     4                            .00415,   .00331,   .00270,   .00217/ 00035110
      DATA(KY4(I,7,2),I=1,20)/    .07635,   .04365,   .02906,   .02106, 00035120
     1                            .01612,   .01282,   .01049,   .00746, 00035130
     2                            .00525,   .00390,   .00265,   .00189, 00035140
     3                            .00141,   .00099,   .00073,   .00051, 00035150
     4                            .00038,   .00027,   .00020,   .00014/ 00035160
      DATA(KY4(I,8,2),I=1,20)/    .00587,   .00268,   .00151,   .00095, 00035170
     1                            .00065,   .00046,   .00035,   .00021, 00035180
     2                            .00012,   .00007,   .00004,   .00002, 00035190
     3                            .00001,   .00001,   .00000,   .00000, 00035200
     4                            .00000,   .00000,   .00000,   .00000/ 00035210
C                                                                         00035220
C   **** STABILITY CLASS C   ****                                         00035230
C                                                                         00035240
      DATA(KY4(I,1,3),I=1,20)/   1.49523,  1.03471,   .79684,   .65070, 00035250
     1                            .55142,   .47940,   .42466,   .34677, 00035260
     2                            .29855,   .26120,   .22073,   .19172, 00035270
     3                            .16984,   .14780,   .13112,   .11517, 00035280
     4                            .10239,   .09140,   .08236,   .07396/ 00035290
      DATA(KY4(I,2,3),I=1,20)/   1.41091,   .97198,   .74599,   .60749, 00035300
     1                            .51360,   .44561,   .39401,   .32073, 00035310
     2                            .27468,   .23948,   .20145,   .17427, 00035320
     3                            .15383,   .13329,   .11778,   .10301, 00035330
     4                            .09167,   .08108,   .07278,   .06509/ 00035340
      DATA(KY4(I,3,3),I=1,20)/   1.17816,   .80038,   .60784,   .49076, 00035350
     1                            .41190,   .35511,   .31222,   .25169, 00035360
     2                            .21206,   .18290,   .15167,   .12957, 00035370
     3                            .11309,   .09669,   .08442,   .07284, 00035380
     4                            .06403,   .05589,   .04957,   .04376/ 00035390
      DATA(KY4(I,4,3),I=1,20)/    .85348,   .56551,   .42144,   .33508, 00035400
     1                            .27760,   .23662,   .20595,   .16315, 00035410
     2                            .13351,   .11294,   .09129,   .07626, 00035420
     3                            .06524,   .05446,   .04654,   .03919, 00035430
     4                            .03371,   .02874,   .02494,   .02152/ 00035440
      DATA(KY4(I,5,3),I=1,20)/    .51613,   .32892,   .23800,   .18475, 00035450
     1                            .14998,   .12560,   .10761,   .08296, 00035460
     2                            .06487,   .05324,   .04135,   .03336, 00035470
     3                            .02766,   .02224,   .01838,   .01490, 00035480
     4                            .01239,   .01018,   .00854,   .00711/ 00035490
      DATA(KY4(I,6,3),I=1,20)/    .24354,   .14643,   .10140,   .07594, 00035500
     1                            .05981,   .04878,   .04082,   .03022, 00035510
     2                            .02207,   .01732,   .01267,   .00970, 00035520
     3                            .00768,   .00584,   .00459,   .00352, 00035530
     4                            .00278,   .00216,   .00172,   .00136/ 00035540
      DATA(KY4(I,7,3),I=1,20)/    .07967,   .04393,   .02849,   .02024, 00035550
     1                            .01523,   .01194,   .00965,   .00673, 00035560
     2                            .00444,   .00326,   .00218,   .00155, 00035570
     3                            .00114,   .00080,   .00058,   .00041, 00035580
     4                            .00030,   .00022,   .00016,   .00012/ 00035590
      DATA(KY4(I,8,3),I=1,20)/    .01458,   .00705,   .00414,   .00271, 00035600
     1                            .00191,   .00141,   .00108,   .00069, 00035610
     2                            .00039,   .00026,   .00015,   .00009, 00035620
     3                            .00006,   .00004,   .00003,   .00002, 00035630
     4                            .00001,   .00001,   .00000,   .00000/ 00035640
C                                                                         00035650
C   **** STABILITY CLASS D-DAY   ****                                     00035660
C                                                                         00035670
      DATA(KY4(I,1,4),I=1,20)/   3.26073,  2.24913,  1.72811,  1.40865, 00035680
     1                           1.19199,  1.03502,   .91586,   .74655, 00035690
     2                            .64472,   .56424,   .47700,   .41445, 00035700
     3                            .36725,   .31969,   .28368,   .24926, 00035710
     4                            .22274,   .19792,   .17839,   .16024/ 00035720
      DATA(KY4(I,2,4),I=1,20)/   2.99750,  2.05534,  1.57218,  1.27692, 00035730
     1                           1.07723,   .93289,   .82354,   .66858, 00035740
     2                            .57269,   .49869,   .41880,   .36176, 00035750
     3                            .31889,   .27586,   .24342,   .21254, 00035760
     4                            .18885,   .16677,   .14946,   .13345/ 00035770
      DATA(KY4(I,3,4),I=1,20)/   2.32236,  1.56402,  1.18028,   .94818, 00035780
     1                            .79252,   .68083,   .59675,   .47854, 00035790
     2                            .39989,   .34294,   .28226,   .23953, 00035800
     3                            .20783,   .17641,   .15305,   .13110, 00035810
     4                            .11449,   .09922,   .08742,   .07664/ 00035820
      DATA(KY4(I,4,4),I=1,20)/   1.50402,   .98234,   .72445,   .57123, 00035830
     1                            .46999,   .39826,   .34485,   .27081, 00035840
     2                            .21697,   .18130,   .14418,   .11873, 00035850
     3                            .10027,   .08241,   .06946,   .05759, 00035860
     4                            .04884,   .04099,   .03508,   .02981/ 00035870
      DATA(KY4(I,5,4),I=1,20)/    .80260,   .50151,   .35774,   .27458, 00035880
     1                            .22083,   .18345,   .15608,   .11891, 00035890
     2                            .08965,   .07215,   .05460,   .04304, 00035900
     3                            .03496,   .02743,   .02217,   .01754, 00035910
     4                            .01425,   .01142,   .00937,   .00761/ 00035920
      DATA(KY4(I,6,4),I=1,20)/    .34541,   .20338,   .13873,   .10270, 00035930
     1                            .08011,   .06480,   .05385,   .03939, 00035940
     2                            .02737,   .02094,   .01483,   .01102, 00035950
     3                            .00850,   .00626,   .00479,   .00355, 00035960
     4                            .00273,   .00205,   .00159,   .00122/ 00035970
      DATA(KY4(I,7,4),I=1,20)/    .11631,   .06343,   .04084,   .02885, 00035980
     1                            .02163,   .01691,   .01363,   .00946, 00035990
     2                            .00591,   .00424,   .00276,   .00190, 00036000
     3                            .00137,   .00093,   .00066,   .00045, 00036010
     4                            .00032,   .00022,   .00016,   .00011/ 00036020
      DATA(KY4(I,8,4),I=1,20)/    .02940,   .01455,   .00871,   .00580, 00036030
     1                            .00414,   .00310,   .00240,   .00156, 00036040
     2                            .00085,   .00056,   .00033,   .00021, 00036050
     3                            .00014,   .00008,   .00005,   .00003, 00036060
     4                            .00002,   .00001,   .00001,   .00001/ 00036070
      DATA(KY4(I,1,5),I=1,20)/   3.26073,  2.24913,  1.72811,  1.40865, 00036080
C                                                                       00036090
C   **** STABILITY CLASS D-NIGHT ****                                   00036100
C                                                                       00036110
     1                           1.19199,  1.03502,   .91586,   .74655, 00036120
     2                            .64472,   .56424,   .47700,   .41445, 00036130
     3                            .36725,   .31969,   .28368,   .24926, 00036140
     4                            .22274,   .19792,   .17839,   .16024/ 00036150
      DATA(KY4(I,2,5),I=1,20)/   2.99750,  2.05534,  1.57218,  1.27692, 00036160
     1                           1.07723,   .93289,   .82354,   .66858, 00036170
     2                            .57269,   .49869,   .41880,   .36176, 00036180
     3                            .31889,   .27586,   .24342,   .21254, 00036190
     4                            .18885,   .16677,   .14946,   .13345/ 00036200
      DATA(KY4(I,3,5),I=1,20)/   2.32236,  1.56402,  1.18028,   .94818, 00036210
     1                            .79252,   .68083,   .59675,   .47854, 00036220
     2                            .39989,   .34294,   .28226,   .23953, 00036230
     3                            .20783,   .17641,   .15305,   .13110, 00036240
     4                            .11449,   .09922,   .08742,   .07664/ 00036250
      DATA(KY4(I,4,5),I=1,20)/   1.50402,   .98234,   .72445,   .57123, 00036260
     1                            .46999,   .39826,   .34485,   .27081, 00036270
     2                            .21697,   .18130,   .14418,   .11873, 00036280
     3                            .10027,   .08241,   .06946,   .05759, 00036290
     4                            .04884,   .04099,   .03508,   .02981/ 00036300
      DATA(KY4(I,5,5),I=1,20)/    .80260,   .50151,   .35774,   .27458, 00036310
     1                            .22083,   .18345,   .15608,   .11891, 00036320
     2                            .08965,   .07215,   .05460,   .04304, 00036330
     3                              .03496,    .02743,    .02217,    .01754, 00036340
     4                              .01425,    .01142,    .00937,    .00761/ 00036350
      DATA(KY4(I,6,5),I=1,20)/      .34541,    .20338,    .13873,    .10270, 00036360
     1                              .08011,    .06480,    .05385,    .03939, 00036370
     2                              .02737,    .02094,    .01483,    .01102, 00036380
     3                              .00850,    .00626,    .00479,    .00355, 00036390
     4                              .00273,    .00205,    .00159,    .00122/ 00036400
      DATA(KY4(I,7,5),I=1,20)/      .11631,    .06343,    .04084,    .02885, 00036410
     1                              .02163,    .01691,    .01363,    .00946, 00036420
     2                              .00591,    .00424,    .00276,    .00190, 00036430
     3                              .00137,    .00093,    .00066,    .00045, 00036440
     4                              .00032,    .00022,    .00016,    .00011/ 00036450
      DATA(KY4(I,8,5),I=1,20)/      .02940,    .01455,    .00871,    .00580, 00036460
     1                              .00414,    .00310,    .00240,    .00156, 00036470
     2                              .00085,    .00056,    .00033,    .00021, 00036480
     3                              .00014,    .00008,    .00005,    .00003, 00036490
     4                              .00002,    .00001,    .00001,    .00001/ 00036500
C                                                                         00036510
C   **** STABILITY CLASS E ****                                           00036520
C                                                                         00036530
      DATA(KY4(I,1,6),I=1,20)/     6.30146,   4.35357,   3.34890,   2.73225, 00036540
     1                             2.31370,   2.01025,   1.77976,   1.45205, 00036550
     2                             1.23134,   1.07713,    .91008,    .79034, 00036560
     3                              .70005,    .60909,    .54026,    .47450, 00036570
     4                              .42385,    .37647,    .33919,    .30456/ 00036580
      DATA(KY4(I,2,6),I=1,20)/     5.71981,   3.92351,   3.00182,   2.43837, 00036590
     1                             2.05719,   1.78162,   1.57283,   1.27688, 00036600
     2                             1.07786,    .93768,    .78649,    .67866, 00036610
     3                              .59769,    .51650,    .45533,    .39716, 00036620
     4                              .35257,    .31105,    .27852,    .24846/ 00036630
      DATA(KY4(I,3,6),I=1,20)/     4.27358,   2.86894,   2.15959,   1.73124, 00036640
     1                             1.44438,   1.23879,   1.08420,    .86718, 00036650
     2                              .72203,    .61775,    .50690,    .42906, 00036660
     3                              .37142,    .31442,    .27213,    .23249, 00036670
     4                              .20256,    .17511,    .15392,    .13462/ 00036680
      DATA(KY4(I,4,6),I=1,20)/     2.62078,   1.69688,   1.24296,    .97461, 00036690
     1                              .79803,    .67337,    .58086,    .45311, 00036700
     2                              .36867,    .30674,    .24260,    .19882, 00036710
     3                              .16720,    .13675,    .11475,    .09468, 00036720
     4                              .07995,    .06679,    .05691,    .04816/ 00036730
      DATA(KY4(I,5,6),I=1,20)/     1.31280,    .80763,    .56921,    .43257, 00036740
     1                              .34494,    .28442,    .24037,    .18099, 00036750
     2                              .14254,    .11401,    .08559,    .06702, 00036760
     3                              .05410,    .04214,    .03385,    .02659, 00036770
     4                              .02148,    .01710,    .01394,    .01126/ 00036780
      DATA(KY4(I,6,6),I=1,20)/      .53345,    .30703,    .20579,    .15015, 00036790
     1                              .11567,    .09255,    .07616,    .05476, 00036800
     2                              .04134,    .03140,    .02203,    .01625, 00036810
     3                              .01244,    .00909,    .00690,    .00508, 00036820
     4                              .00388,    .00290,    .00223,    .00170/ 00036830
      DATA(KY4(I,7,6),I=1,20)/      .17425,    .09232,    .05814,    .04032, 00036840
     1                              .02976,    .02294,    .01826,    .01240, 00036850
     2                              .00888,    .00633,    .00408,    .00280, 00036860
     3                              .00200,    .00135,    .00096,    .00065, 00036870
     4                              .00046,    .00032,    .00023,    .00016/ 00036880
      DATA(KY4(I,8,6),I=1,20)/      .04522,    .02169,    .01267,    .00826, 00036890
     1                              .00579,    .00427,    .00326,    .00207, 00036900
     2                              .00139,    .00092,    .00053,    .00034, 00036910
     3                              .00022,    .00014,    .00009,    .00005, 00036920
     4                              .00004,    .00002,    .00001,    .00001/ 00036930
C                                                                         00036940
C   **** STABILITY CLASS F ****                                           00036950
C                                                                         00036960
      DATA(KY4(I,1,7),I=1,20)/     9.48875,   6.55828,   5.04627,   4.11799, 00036970
     1                            3.48780,  3.03084,  2.68369,  2.19002,
     2                            1.86742,  1.62952,  1.37253,  1.18885,
     3                            1.05068,   .91183,   .80700,   .70738,
     4                             .63028,   .55860,   .50232,   .45014/
      DATA(KY4(I,2,7),I=1,20)/    8.64839,  5.73611,  4.54369,  3.69213,
     1                            3.11587,  2.69916,  2.38335,  1.93559,
     2                            1.64091,  1.42515,  1.19300,  1.02779,
     3                             .90399,   .78007,   .68689,   .59842,
     4                             .53071,   .46776,   .41852,   .37306/
      DATA(KY4(I,3,7),I=1,20)/    6.54557,  4.40007,  3.31538,  2.65984,
     1                            2.22055,  1.90554,  1.66855,  1.33564,
     2                            1.11273,   .95284,   .78297,   .66372,
     3                             .57542,   .49811,   .42329,   .36253,
     4                             .31661,   .27445,   .24189,   .21219/
      DATA(KY4(I,4,7),I=1,20)/    4.10910,  2.66763,  1.95786,  1.53757,
     1                            1.26063,  1.06489,   .91949,   .71848,
     2                             .58137,   .48621,   .38733,   .31958,
     3                             .27047,   .22296,   .18848,   .15688,
     4                             .13354,   .11258,   .09676,   .08264/
      DATA(KY4(I,5,7),I=1,20)/    2.13548,  1.32008,   .93369,   .71159,
     1                             .56878,   .46994,   .39787,   .30052,
     2                             .23341,   .18882,   .14401,   .11438,
     3                             .09358,   .07410,   .06044,   .04832,
     4                             .03968,   .03217,   .02668,   .02195/
      DATA(KY4(I,6,7),I=1,20)/     .91624,   .53163,   .35848,   .26281,
     1                             .20328,   .16321,   .13471,   .09738,
     2                             .07173,   .05559,   .04007,   .03030,
     3                             .02373,   .01784,   .01389,   .01054,
     4                             .00826,   .00637,   .00505,   .00395/
      DATA(KY4(I,7,7),I=1,20)/     .32341,   .17358,   .11036,   .07714,
     1                             .05730,   .04441,   .03553,   .02433,
     2                             .01679,   .01234,   .00830,   .00591,
     3                             .00439,   .00309,   .00227,   .00162,
     4                             .00120,   .00087,   .00065,   .00048/
      DATA(KY4(I,8,7),I=1,20)/     .09350,   .04573,   .02711,   .01790,
     1                             .01267,   .00942,   .00726,   .00466,
     2                             .00298,   .00205,   .00127,   .00084,
     3                             .00059,   .00038,   .00026,   .00017,
     4                             .00012,   .00008,   .00006,   .00004/
C
C     USE THE AVERAGING TIME OPTION (NTOPT) TO SELECT PROPER
C     VALUES FOR KY, ANGLIM, AND DEL.
C
      IF(NTOPT.EQ.1.OR.NTOPT.EQ.7)  GO TO 50
      IF(NTOPT.EQ.2)  GO TO 70
      IF(NTOPT.EQ.3.OR.NTOPT.EQ.6.OR.NTOPT.EQ.8) GO TO 90
      IF(NTOPT.EQ.4.OR.NTOPT.EQ.5) GO TO 110
C
50    DO 60 ISC = 1,7
      DEL(ISC) = DEL1(ISC)
      ANGLIM(ISC) = ANGLI1(ISC)
      DO 60 NANG = 1, 8
      DO 60 NDIST = 1, 20
      KY(NDIST,NANG,ISC) = KY1(NDIST,NANG,ISC)
60    CONTINUE
      RETURN
C
70    DO 80 ISC = 1, 7
      DEL(ISC) = DEL2(ISC)
      ANGLIM(ISC) =ANGLI2(ISC)
      DO 80 NANG = 1, 8
      DO 80 NDIST = 1, 20
      KY(NDIST,NANG,ISC) = KY2(NDIST,NANG,ISC)
80    CONTINUE
```

```
      RETURN
C
90    DO 100 ISC = 1, 7
      DEL(ISC) = DEL3(ISC)
      ANGLIM(ISC) = ANGLI3(ISC)
      DO 100 NANG = 1, 8
      DO 100 NDIST = 1, 20
      KY(NDIST,NANG,ISC) = KY3(NDIST,NANG,ISC)
100   CONTINUE
      RETURN
C
110   DO 120 ISC = 1, 7
      DEL(ISC) = DEL4(ISC)
      ANGLIM(ISC) = ANGLI4(ISC)
      DO 120 NANG = 1, 8
      DO 120 NDIST = 1, 20
      KY(NDIST,NANG,ISC) = KY4(NDIST,NANG,ISC)
120   CONTINUE
      RETURN
      END
```